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"Experimental Farm, Fredericton, N.B.



# EXPERIMENTAL FARM

Fredericton, New Brunswick



PROGRESS REPORT

1953-1957

EXPERIMENTAL FARMS SERVICE  
CANADA DEPARTMENT OF AGRICULTURE  
OTTAWA, ONTARIO



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## EXPERIMENTAL FARM

Fredericton, New Brunswick

RESEARCH STAFF—DECEMBER 31, 1957

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<sup>2</sup> Appointed, October 1, 1956.

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## **INTRODUCTION**

This report, covering the period 1953 to 1957, inclusive, is a continuation of the progress reports published since the Farm was established in 1912. The major phases of the research program conducted during the past five years are reported. Space does not permit the inclusion of all work undertaken. Inquiries are invited for further information on projects outlined, or on any problem not mentioned in this report.

Details of the work conducted at the Fruit and Vegetable Substation at McDonald's Corner and the Blueberry Substation, Tower Hill, are reported in separate publications. The section of this report on potato breeding includes the work at the Potato Substation, Alma.

In 1956, the administration of all land formerly owned by the Science Service at Fredericton was transferred to this Farm. A total of 1,166 acres is now administered by the Experimental Farms Service in New Brunswick, besides thirteen Illustration Stations in various parts of the province where research projects are conducted on privately owned farms.

## METEOROLOGICAL RECORDS

These records were taken in co-operation with the Meteorological Branch of Air Services, Department of Transport.

TABLE 1.—TEMPERATURE, PRECIPITATION, AND SUNSHINE RECORDS—  
DOMINION EXPERIMENTAL FARM, FREDERICTON, N.B., 1914-1957  
(44-year averages)

Month	Temperature °F.			Precipitation			Bright sun-shine
	Mean maximum	Mean minimum	Mean	Rain	Snow	Total precipitation	
			in.	in.	in.	hr.	
January.....	24.4	4.2	14.3	1.39	22.6	3.65	101.2
February.....	26.8	4.9	15.9	0.91	20.8	2.99	119.3
March.....	36.4	17.1	26.8	1.65	15.0	3.15	142.3
April.....	49.3	29.5	39.4	2.68	7.2	3.40	158.2
May.....	61.3	38.4	50.6	3.04	—	3.04	203.1
June.....	72.2	48.9	60.6	3.57	—	3.57	203.1
July.....	77.9	55.0	66.5	3.31	—	3.31	229.7
August.....	75.9	53.1	64.5	3.41	—	3.41	216.5
September.....	67.3	45.8	56.6	3.52	—	3.52	161.3
October.....	56.0	36.2	46.1	3.70	—	3.70	143.9
November.....	41.7	26.3	34.0	3.04	7.0	3.74	91.1
December.....	28.5	11.5	20.0	1.71	17.3	3.44	88.5
Total.....				31.93	89.9	40.92	1858.2

TABLE 2.—SPRING WORK, FROST AND FREEZE-UP RECORDS, DOMINION EXPERIMENTAL FARM, FREDERICTON, N.B. (1953-1957) AND AVERAGES\*  
Frost-temperature lower than 32.6°F.

Year	Date of beginning work on the land	Date of last frost in spring	Number of days in which frost occurred			Date of first frost in the fall	Frost-free period	**Date of freeze-up
			June	July	Aug.			
1953	May 4	May 3	0	0	0	Sept. 30	149	Nov. 30
1954	Apr. 26	May 13	0	0	0	Oct. 7	146	Nov. 27
1955	Apr. 23	Apr. 25	0	0	0	Sept. 14	141	Nov. 20
1956	Apr. 26	May 27	0	0	0	Sept. 24	119	Nov. 24
1957.....	May 6	May 19	0	0	0	Sept. 25	128	Nov. 25
5-year Average 1953-1957.....	Apr. 29	May 11	0	0	0	Sept. 26	136.6	Nov. 25
10-year Average 1948-1957.....	Apr. 29	May 14	0	0	0	Sept. 25	132.6	Nov. 25
44-year Average 1914-1957.....	—	May 18	4	0	0	Sept. 26	130.0	—

\* For records of previous years see the 1937-47 and 1948-52 Progress Report from this Farm.

\*\* Date beyond which work could not be done on the land.

Date of latest spring frost on record..... June 9, 1914

Date of earliest fall frost on record..... September 8, 1917

Shortest frost-free period on record..... 102 days in 1917

Longest frost-free period on record..... 154 days in 1933

## ANIMAL HUSBANDRY

(R. J. Curtis)

### Swine

#### Development of Prepotent Lines of Yorkshires

Work was undertaken to develop a strain of Yorkshires that would combine carcass quality, early maturity, and feed efficiency, and that would be suitable for improving the commercial stock in the province.

Prior to 1953, two inbred lines of Yorkshires had been developed at Fredericton. One was descended from a high-scoring line in Prince Edward Island and the second (Napton) from a combination of lines from the Experimental Farms at Nappan, N.S., and Brandon, Man. The Island and Napton lines were combined to form the present Fredericton swine herd. Intensive culling was practiced throughout the five-year period and the first breeding stock to be sold to outside breeders was distributed in 1956. Only the progeny of sows qualified in Advanced Registry were distributed to commercial swine producers in the province.

The project was well advanced by the end of 1957 and breeding stock from the herd had been sold to many progressive breeders in New Brunswick. Plans have been laid for gathering information on the performance of breeding stock from the Farm through market grading reports and Advanced Registry scores with co-operation from the Production and Marketing Services, and the Livestock Branch of the New Brunswick Department of Agriculture.

Average numbers of pigs born alive and weaned per litter, eight-week (weaning) weights, and Advanced Registry carcass scores for the strain crosses during each of the five years (1953-57) are given in the following tables.

TABLE 3.—PERFORMANCE OF FREDERICTON YORKSHIRES (1953-1957)  
DATA ON LITTERS TO WEANING

Year	Number of litters farrowed	Average no. born alive per litter	Average no. weaned per litter	Average wt. in lb. of 8-week-old pigs
1953.....	17	8.1	7.0	36.9
1954.....	15	8.7	7.4	39.7
1955.....	28	10.6	9.1	30.3
1956.....	32	9.6	7.8	31.4
1957.....	33	10.0	8.4	31.7

TABLE 4.—PERFORMANCE OF FREDERICTON YORKSHIRES (1953-57) ADVANCED REGISTRY DATA ON LITTERS

Year	Number of advanced registry tests	Lb. feed consumed per 100 lb. carcass gain	Average age at slaughter (days)	Average total advanced registry carcass score	Length (20)	Backfat (20)	Balance (10)	Belly (20)	Loin (20)	Type (10)
1953	8	438.6	153.4	70.6	11.5	6.3	7.5	16.2	18.1	9.6
1954	11	445.6	162.1	75.3	14.5	8.1	6.9	17.2	18.1	9.2
1955	16	443.4	169.6	74.7	14.4	8.4	7.4	16.8	18.5	9.3
1956	5	438.6	169.2	76.2	14.6	8.8	8.0	16.6	19.2	9.0
1957	12	442.8	168.8	74.6	16.9	9.8	7.1	14.4	16.5	9.8

Data in Table 4 on the Fredericton herd indicates that belly and loin scores are very satisfactory, and length and backfat scores less satisfactory, although these are improving every year. Numbers born alive and pigs weaned per litter, and eight-week (weaning) weights, are satisfactory.

Future plans call for an outcross to improve length and backfat characteristics and overall carcass score, while retaining desirable feed efficiency and early maturity.

### Dry Feed versus Slop Feed for Market Hogs

During 1953 and 1954 eight groups of feeders, totalling 42 hogs, were carried through to market in this test. The test was designed primarily to find the effect of dry self-feeding on market quality, age at market weight, feed efficiency, and the possible incidence of rhinitis in the Fredericton herd. The occurrence of rhinitis in two Experimental Farm pigs at the Advanced Registry station prompted this investigation. A theory was advanced that the inhaling of dusty feed might be a predisposing factor in contracting infectious atrophic rhinitis.

Half of the hogs in the trial were on self-feeders while the other half were slop-fed. All hogs received the standard Advanced Registry test ration.

Dry-fed hogs went to market at an average age of 158.8 days as compared with 163.8 days for the slop-fed hogs, a difference of five days in favor of the former. Dry-fed hogs consumed 490.8 pounds of feed per 100 pounds of carcass gain compared with 425.1 pounds for slop-fed hogs. The average loin area for both groups was 3.96 square inches. Slop-fed hogs averaged 1.7 points more for length and 2.2 points more for backfat score than did the dry self-fed pigs. Only slight differences occurred in other factors. Summarizing, the average carcass score is 76.6 for slop-feeders and 72.7 for self-feeders. Though this is a difference of only 3.9 points, it is the difference between a qualifying and non-qualifying score. At slaughter the heads of all hogs in this trial were examined by veterinarians of the Health of Animals Division and no trace of infectious atrophic rhinitis or any similar condition was found.

The only significant difference ( $p=.02$ ) noted between the two types of feeding was in the amount of feed used. Though no actual figures on feed wastage were recorded it was observed that a considerable amount of feed was wasted by the self-fed hogs until the self-feeder in use was remodelled.

Self-fed hogs tended to grow shorter and thicker than those on slop feed. If more bulk were introduced into the self-fed ration during the growing period this serious fault might be overcome.

### Source of Rhinitis Infection

Following the discovery of rhinitis in two Experimental Farm feeders at the Advanced Registry Feeding Station, a study was made of the Experimental Farm herd at Fredericton to determine whether rhinitis existed in the breeding stock. It was generally accepted at that time that pigs over 8 weeks of age do not contract the disease. Several entire litters from the dams of those pigs found with the disease at the Feeding Station were slaughtered and checked by a representative of the Animal Pathology Division. No trace of the disease was found. All sows and boars that were disposed of during 1953, as well as littermates of the infected pigs, were also slaughtered and examined. No symptoms were found.

## Dairy Cattle

### Master Breeder Award

In 1956 a Master Breeder Shield was presented to the Fredericton Experimental Farm by the Holstein-Friesian Association of Canada. This is the highest award presented to members of this Association. During the period recognized by this award the Fredericton Holstein herd averaged thirty head.

### Inheritance Studies with Dairy Cattle

Most of the branch Experimental Farms and the Central Farm at Ottawa are co-operating in these studies. Until 1957 the Fredericton Experimental

Farm was involved only to the extent of collecting data on cow and calf weights and production records during the first 180 days of lactation.

All females of the Holstein herd from birth up to 180 days of the second lactation are involved in the project. All virgin and first lactation heifers are bred artificially to young bulls maintained at the Central Experimental Farm in Ottawa. Since April, 1957, accurate records of body weight, type characteristics, and physiological measurements as well as production data (milk, butterfat, solids-not-fat) are being kept. Older cows are bred to proven bulls to provide a good selection of young bulls to be used in the project. One bull was provided by the Fredericton herd for this work in 1956.

This is a long-term study that could conceivably give much valuable information on the inheritance of many characteristics of economic importance to dairymen, as well as data on growth rates and the relationship between various characteristics in dairy cattle.

#### **Grass Silage and Potatoes for Lactating Dairy Cows**

Early in 1957, twelve Holstein cows were placed on a feeding trial designed to study the complementary effect of grass silage and potatoes and the effect of increasing meal supplement protein when replacing grass silage with potatoes in dairy cow rations. This experiment is being conducted in co-operation with the Experimental Farm, Charlottetown, P.E.I., where an Ayrshire herd is maintained. Observations from the first winter's results were that cows fed a ration with all of the silage portion replaced by potatoes came through the trial in good condition and milked as well as when receiving silage. Some of the cows consumed up to 65 pounds of potatoes daily with no apparent ill effects.

#### **Losses in Ensiling Various Crops**

In co-operation with the Field Husbandry division at this Farm a study was made of losses in ensiling corn and grass silages over a period of several years. From the results of this trial it appears that losses in ensiling may amount to as much as 30 per cent if the forage is wet when ensiled. Under normal conditions the total loss in weight from spoilage, seepage, and fermentation was, on the average, 23 per cent. The average loss of dry matter over a four-year period was 14 per cent.

## **POULTRY**

*(L. Griesbach)*

#### **Reciprocal Recurrent Selection for Weight**

Crossbreeding is now being practiced extensively with poultry to take advantage of heterosis. A breeding program that would allow the breeder to select for and improve the combining ability of two strains or breeds, to increase heterosis, should be of considerable value. Such an opportunity would seem to be offered by the technique known as reciprocal recurrent selection.

An experiment was started at the Fredericton Station in 1951 to study the results of reciprocal recurrent selection for body weight of chicken broilers. The first phase of the experiment, during which eight broiler strains were tested for combining ability with the Station Strain of Barred Plymouth Rocks, ended in 1954. Six of the eight broiler strains crossed with the Barred Rocks, produced crossbreds with a heavier average weight than either of the purebred parental strains. In every case the crossbreds were heavier than the average of their purebred parental strains.

Selection was initiated in 1955 with two breeds, one of the broiler strains of New Hampshires (N.H.) and Barred Plymouth Rocks, (B.R.). Selection within each of these two breeds during the second phase of the experiment was based entirely on the body weights of crossbreds at 10 weeks of age. Selection was practiced with both sires and dams.

TABLE 5.—AVERAGE 10-WEEK BODY WEIGHTS OF PROGENY FROM TEST CROSSES AND PUREBRED MATINGS

Breed or Cross	Year					
	1955		1956		1957	
	Males	Females	Males	Females	Males	Females
gm.	gm.	gm.	gm.	gm.	gm.	gm.
B.R. ....	1,529	1,285	1,424	1,098	1,523	1,197
N.H. ....	1,874	1,505	1,778	1,341	1,849	1,423
B.R. × N.H. ....	1,799	1,420	1,690	1,315	1,886	1,440
N.H. × B.R. ....	1,768	1,437	1,645	1,315	1,827	1,418

The average body weights of progeny from test crosses and purebred matings are shown in Table 5. No definite trend is indicated when each breed or cross is considered by itself and there is no apparent reason for the relatively low weights of all lots in 1956. The differences between weights of purebreds and crossbreds, however, reveal the extent of heterosis, and these are shown in Table 6, when the sexes and strains are combined. In the initial year of selection, the crossbreds averaged 3.7 per cent above the midparental value. In the next two generations of selection, the average body weights of the crossbreds were 5.7 and 9.7 per cent, respectively, above the midparental values.

TABLE 6.—AVERAGE 10-WEEK BODY WEIGHT OF CROSSBREDS AND PUREBREDS

	Year		
	1955	1956	1957
	gm.	gm.	gm.
Purebreds. ....	1,548	1,410	1,498
Crossbreds. ....	1,606	1,491	1,643

The average 10-week weights of replacement stocks are shown in Table 7. Selection within the purebred strains on the basis of the 10-week weights of crossbred progeny, appears to have increased slightly the body weight of purebred replacement stock. There was some variation in weights of the different

TABLE 7.—AVERAGE 10-WEEK WEIGHT OF REPLACEMENT STOCK

Strain	Year					
	1955		1956		1957	
	Males	Females	Males	Females	Males	Females
gm.	gm.	gm.	gm.	gm.	gm.	gm.
B.R. Control. ....	1,482	1,180	1,572	1,252	1,494	1,225
B.R. Selected. ....	1,563	1,240	1,703	1,333	1,594	1,258
N.H. Control. ....	1,798	1,418	1,882	1,451	1,752	1,375
N.H. Selected. ....	1,820	1,426	1,890	1,451	1,844	1,443

strains from 1955 to 1957, but during this period the control strains decreased in weight an average of .5 per cent whereas the selected strains increased 1.5 per cent in average weight.

Increases in body weights of crossbreds over the midparental values were obtained even though the selected parental strains also increased in weight. This indicates an increase in heterosis due to selection.

### **Developing a Dominant White Broiler Strain**

Some preliminary work has been done at Fredericton in developing a dominant white broiler strain. Crosses between the Broad Breasted white breed developed at Ottawa and two outstanding broiler strains of New Hampshires showed considerable promise. The dominant white, gold segregates from these crosses formed the basis of a new breed which it was thought might find a useful place in broiler breeding operations. There appears to be a need locally for this type of breeding but it has been slow to develop.

Pullets from the original cross of Broad Breasted White and New Hampshire produced 225 eggs, on a survivor basis, to 500 days of age. This is considerably higher than either of the parental strains and higher than the production-bred Barred Rocks maintained at Fredericton. The new broiler strain lays fewer eggs than the original cross but production is usually maintained at a level only slightly below the Barred Rocks. The average body weight of the new broiler strain males at 10 weeks of age in 1957 was 1,640 grams. This is 146 grams more than the unselected Fredericton Strain Barred Rocks in the same hatch. Crosses between the new broiler strain and Barred Rocks, and also those with Columbian Rocks, were slightly heavier at 10 weeks of age than the purebred broiler strain chicks. The breed has good width of breast and appears to have other good fleshing qualities. The males, mated to Light Sussex or Columbian Rocks, produce sex-linked chicks. While there are heavier commercial broiler strains available, this one may find a useful place in broiler breeding operations because of its desirable conformation and its color genotype.

### **Brooding Strains Separately and Intermingled**

In 1954, body weights of broilers were determined from six pens in two hatches. Differences between pens in average weight of broilers were not statistically significant. The following year, two pens of New Hampshires and two pens of Barred Rocks were brooded separately in two pens and intermingled in two pens. The average weights of New Hampshires brooded separately and intermingled were 1,586 grams and 1,633 grams, respectively; for Barred Rocks, the weights were 1,330 grams and 1,335 grams. These results indicate that approximately the same weights would be obtained whether the strains were brooded separately or intermingled. Brooding the strains separately would permit feed efficiency data to be collected.

### **Broiler Strains and Dual-Purpose Strains for Meat and Egg Production**

The unselected strain of Barred Rocks produced in a 3-year period an average of 204 eggs on a survivor basis, to 500 days of age. A broiler strain of New Hampshires produced an average of 162 eggs. During this same period the average 10-week weight of males was 3.3 pounds for Barred Rocks and 4.0 pounds for New Hampshires. Crossbred pullets from this New Hampshire broiler strain and Columbian Rocks are producing eggs during the current year, at a higher rate than any other strain at Fredericton. The males from this same cross averaged 3.8 pounds in weight at 10 weeks of age.

These results show interesting possibilities for poultry breeders. Some of the high egg-producing dual-purpose strains now available, might be suitable

as a female line, in conjunction with outstanding broiler strain males, in a crossbreeding program for broiler production. It is important, however, that actual tests of specific crosses be carried on before claims are made for the crossbred progeny. It should also be noted that purebred pullets of broiler strains are not likely to be economical producers of market eggs because of their large body size and relatively low egg production.

#### **Limestone as a Source of Calcium for Poultry**

A local "marble" limestone product was compared with insoluble grit and oyster shell for laying hens. The test was conducted during the summer months of 1956 with Barred Rocks and New Hampshires divided among 12 pens of 16 birds each. One-half received "marble" limestone grit in hoppers and the other half insoluble grit plus oyster shell. An all-mash ration was fed. All eggs laid on two successive days of each week were immersed in a salt solution, the specific gravity of which was 1.078 at 60°F. The number of sinkers and floaters were recorded as a measure of shell quality, the sinkers having the better shells.

The number of sinkers represented 52 per cent of the eggs tested from the birds fed "marble" limestone and 42 per cent from those fed insoluble grit plus oyster shell. These differences were not statistically significant. The average egg production was the same for both lots. The birds receiving limestone consumed an average of about 14 ounces of the product per bird for the period. The other birds consumed about 15 ounces of oyster shell each and about 1½ ounces of insoluble grit.

In September 1956, the entire flock of over 900 pullets was placed on "marble" limestone grit as the only source of supplementary calcium. Specific gravity tests were taken in May the following year and the egg shell quality was better than a year earlier when the birds had been receiving insoluble grit and oyster shell.

These results indicate that a good grade of this "marble" limestone, practically free from deleterious material such as magnesium and fluorine, can replace imported oyster shell as a supplementary source of calcium for egg shell formation. It should also be a satisfactory source of calcium for incorporating into various poultry mashes to bring the calcium content up to the required level.

## **FIELD CROPS**

(*T. C. Chiasson*)

### **Oats**

#### **Fundy Oats**

A new oat variety, "Fundy" was licenced and distributed to growers in 1957.

Fundy is one of approximately 350 selections from the cross Ajax × Abegweit made in the Cereal Crops Division, Ottawa, in 1946. After several years testing at Fredericton, the selection, later named Fundy, appeared to be higher yielding than Ajax. It has a larger kernel, is slightly earlier and has stronger straw than Ajax. While it yields about the same as Abegweit it matures over a week earlier.

Reports from farmers who grew Fundy in 1957 confirm the experimental findings and indicate that Fundy will fill a long-felt need for a high yielding, early maturing oat variety with an attractive kernel.

### Variety Testing

A number of oat varieties and strains have been tested during the past five years. Data from those varieties that showed sufficient promise to be retained for a period of three years are shown in Table 8.

TABLE 8.—OATS—EASTERN CO-OPERATIVE TEST  
(3-year average, 1955-1957)

Variety	Yield	Maturity	Length	Lodging	Weight	Weight	Hull
	per acre		of straw	resistance	per bushel	per 1,000 kernels	%
	bu.	days	in.	1-9*	lb.	gm.	
Fundy.....	105.0	100.7	48.6	4.6	33.0	32.5	28.2
Abegweit.....	101.5	108.9	46.2	6.5	31.7	30.5	27.2
Ajax.....	101.3	102.8	49.1	5.4	32.7	27.9	28.0
Simcoe.....	100.5	100.3	49.4	5.7	32.7	30.1	25.3
Beaver.....	99.5	103.9	47.7	5.6	31.3	34.7	25.2
Shefford.....	96.9	103.0	49.6	4.9	30.3	34.8	21.8
Scotian.....	96.4	104.6	49.3	5.2	32.7	33.4	25.0
Glen.....	95.8	105.5	47.8	6.3	30.3	32.9	27.5
Garry.....	95.6	108.2	47.0	6.9	34.7	30.3	28.7
Shield.....	92.0	99.5	43.1	4.7	34.7	29.5	25.3
Rodney.....	84.0	107.9	48.4	6.5	32.0	28.6	30.0
Victory.....	79.1	113.4	50.9	7.2	32.7	29.8	28.7

\*1=no lodging, 9=all lodged.

The highest yield obtained in this test was with the variety Fundy. It matured 8.2 days ahead of Abegweit and 2.1 days ahead of Ajax. It had less lodging than either variety and was equal to Abegweit in size of kernel. Shield, the earliest variety, yielded 13.0 bushels less per acre than Fundy and had a much smaller kernel. Garry, which has excellent rust resistance, gave 9.4 bushels less per acre than Fundy and was approximately eight days later maturing. Damage by rust to early seeded grain is of rather rare occurrence. Therefore it appears that Fundy would be the best variety for this area.

### Wheat

#### Spring Wheat

Spring wheat is a minor cereal crop in New Brunswick at the present time. Since substantial amounts of this grain are imported into this province each year many farmers could profitably grow a few acres of spring wheat, especially on fields where lodging of oats or barley is a perennial problem. Such areas should be suitable for wheat, provided they can be seeded reasonably early. Lodging is rarely a problem with this crop.

Four varieties of spring wheat were tested for a period of four years. Selkirk was the highest yielding variety in this test. It is a hard, red, beardless spring wheat, relatively early maturing, resistant to lodging, shattering, and sprouting. It is resistant to stem rust and moderately resistant to leaf rust.

Huron, is an old variety which yields well as long as rusts are not abundant. Because of its late maturity and lack of resistance to diseases it is not recommended.

Cascade has been a good yielding variety for a number of years. Because of its tendency to sprout in the stock or bin it is no longer recommended for this area.

Acadia is still recommended for this area because of its early maturity and good resistance to diseases.

### Winter Wheat

A number of varieties and strains of winter wheat have been tested each year since 1954. Results indicate that this crop must be considered too precarious for areas with climate and soils similar to those in the Fredericton area. It is recognized that some areas of New Brunswick have climate and soils that may be much better suited to winter wheat production and tests have been established in some of those areas.

Results of variety tests at Fredericton indicate that Fairfield is the best adapted variety from the standpoint of yield and winter hardiness. The varieties Genesee and Rideau, while somewhat inferior, also show promise.

### Barley

Many varieties and strains of barley have been tested at Fredericton during the past five years. Most of the strains and varieties were of the six-row type but in recent years a number of two-row varieties, originating mostly in Europe, have also been tested to determine their suitability in this area. Results for varieties retained for a three-year period are shown in Tables 9 and 10.

TABLE 9.—BARLEY—EASTERN CO-OPERATIVE TEST  
(3-year average, 1955-1957)

Variety	Yield per acre	Maturity	Length of straw	Lodging resistance	Weight per bushel	Wt. per 1,000 kernels
	bushels	days	in.	1-9	lb.	gm.
Brant.....	65.6	100.1	35.6	2.5	48.3	34.7
Parkland.....	65.4	100.7	35.9	1.0	49.3	36.2
Herta*.....	61.7	106.5	31.9	1.8	52.7	40.9
O.A.C. 21.....	61.5	98.7	39.5	2.0	47.7	35.3
Montcalm.....	58.9	101.5	38.5	2.3	49.3	37.5
Fort.....	56.1	99.6	37.1	1.0	49.0	34.7
Charlottetown 80*.....	55.6	104.7	36.4	2.4	51.7	38.9

\*Two-row varieties

TABLE 10.—BARLEY UNIFORM TWO-ROW TEST  
(3-year average, 1955-1957)

Variety	Yield per acre	Maturity	Length of straw	Lodging resistance	Weight per bushel	Wt. per 1,000 kernels
	bushels	days	in.	1-9	lb.	gm.
Herta.....	63.7	103.7	29.2	1.9	52.7	40.3
O.A.C. 21*.....	62.9	97.1	37.7	2.2	48.3	34.3
Montcalm*.....	62.5	99.4	35.3	2.4	49.3	38.7
Charlottetown 80.....	59.6	103.8	34.8	3.2	51.3	39.0
Carlsberg.....	58.9	105.5	28.5	2.4	48.3	41.9
Hanchen.....	57.6	103.3	32.8	5.4	51.3	37.4
Piroline.....	55.1	99.1	31.9	1.7	51.0	40.7

\*Six-row varieties included for comparisons

In spite of the fact that all six-row varieties have outyielded Charlottetown 80 during the period under test the latter continues to be the most widely grown variety. Two factors appear mainly responsible for this anomaly. One factor is the ability of Charlottetown 80 to grow better than most varieties under such adverse conditions as cold wet spells common in early June. The

second factor is the excellent threshability of Charlottetown 80 which appears superior to nearly all varieties tested. Studies are presently under way to find some method of measuring threshability in experimental plots.

For the reasons given Charlottetown 80 is still the most widely recommended variety. Varieties such as Brant, Parkland, and Herta are recommended for trial only. Fort is recommended where strength of straw is a limiting factor but is not generally recommended because of its susceptibility to smut and the difficulty of removing awns from the kernel.

### Field Beans

#### Lapin Beans

Lapin is a large, white, baking bean which originated in Russia. It was received from Ottawa in 1939 and tested with other varieties since then. As interest in growing field beans increased during the past five years it became evident that Lapin would fill the need for an early maturing, high yielding, disease-resistant variety of good baking quality. Lapin was therefore licenced and distributed to farmers in 1956. Reports, to date, indicate Lapin is giving excellent results and has been well accepted by consumers.

#### Variety Testing

During the past five years farmers have increasingly shown interest in growing field beans as a cash crop.

The varieties most commonly grown in the past were Soldier and Yellow Eye, because consumer preference was such that they generally commanded a premium of ten to fifteen cents per pound over other varieties available. They were also early maturing and thus less subject to loss from fall frosts than later maturing varieties. Tests conducted at the Fredericton Experimental Farm have shown these varieties to be low yielding because of their susceptibility to bacterial blight and anthracnose (Table 11).

TABLE 11.—VARIETY TEST OF FIELD BEANS  
(5-year average, 1952-1957)

Variety	Yield per acre	Maturity	Length of vines	Length of pods	Weight per bushel	Wt. per 1,000 kernels
	bu.	days	in.	in.	lb.	gm.
Clipper.....	37.7	123.7	17.6	3.4	64.6	282.0
Burbank.....	32.0	120.6	16.0	3.3	65.4	235.3
Lapin.....	31.6	114.1	10.0	4.1	66.2	457.4
Mohawk.....	27.2	110.2	10.9	5.0	63.0	610.4
Keneearly Yellow Eye.....	25.1	110.6	11.3	4.1	64.8	545.6
Soldier.....	24.5	109.1	11.6	4.9	62.8	565.6

Results from long-term variety tests at Fredericton indicate that the variety Lapin would fill the needs of New Brunswick growers better than other varieties available, for the following reasons:

- (1) It has a satisfactory maturity range, being only about five days later than Soldier and about nine days earlier than Clipper.
- (2) It shows good resistance to bacterial blight and anthracnose with the result that yields are considerably better than could be obtained with Soldier or Yellow Eye. In addition, growers could use their own seed in producing disease-free crops.

- (3) Lapin is a fairly large bean of good baking quality. It is possible it will be preferred to the small white beans generally imported and may gradually replace Soldier and Yellow Eye in consumer preference.
- (4) Clipper, the highest yielding variety requires too long a growing season to be recommended for commercial production in New Brunswick.

### Fertilizer Formulas for Field Beans

(E. A. Grant, J. E. Comeau)

This study was conducted at the Millville Illustration Station from 1955 to 1957, inclusive. Twenty-seven treatments were used with the three major elements, nitrogen, phosphorus, and potassium studied in all possible combinations. The soil type at this location is classified as Caribou gritty loam. The experimental area had previously been in a three-year rotation of potatoes, grain, and clover hay and during the experiment the rotation was beans —oats —clover. The results for each level of actual nitrogen (N), Phosphorus ( $P_2O_5$ ) and Potassium ( $K_2O$ ) per acre are presented in Table 12.

TABLE 12.—EFFECTS ON YIELDS OF LEVELS OF NUTRIENTS APPLIED TO BEANS

Treatment lb. per acre	Yield in pounds/acre			3-year average
	1955	1956*	1957	
N <sub>1</sub> at 0.....	1,858.9	899.9	1,192.3	1,317.0
N <sub>2</sub> at 50.....	1,946.8	906.1	1,604.0	1,488.9
N <sub>3</sub> at 100.....	1,720.7	872.0	1,672.3	1,421.6
P <sub>1</sub> at 0.....	1,310.8	503.5	865.0	893.1
P <sub>2</sub> at 100.....	1,997.9	1,068.1	1,691.0	1,585.6
P <sub>3</sub> at 200.....	2,217.6	1,106.5	1,912.6	1,745.5
K <sub>1</sub> at 0.....	2,035.2	949.7	1,862.3	1,615.7
K <sub>2</sub> at 100.....	1,871.8	871.3	1,391.6	1,378.2
K <sub>3</sub> at 200.....	1,619.4	857.1	1,214.6	1,230.3

\*Dried pod weights

In 1956 the season was most unsatisfactory for bean production. Low temperatures prevailed and seeding was delayed. The bean plants did not mature, consequently pod yields were taken instead of bean yields. However, the yields of dried pods showed the same effects from the three elements.

The results are summarized as follows:

- (1) The most essential fertilizer element in bean production is  $P_2O_5$ . The rate of 200 pounds per acre appears to be the optimum under the conditions of this test.
- (2) N applied without  $P_2O_5$  depressed yields but with  $P_2O_5$  gave a significant increase.
- (3)  $K_2O$  constantly decreased yields when applied without  $P_2O_5$  but  $P_2O_5$  and  $K_2O$  showed a significant interaction.
- (4) N and  $K_2O$  when applied alone or in combination without  $P_2O_5$  resulted in comparatively weak plants and in some cases in poorer plants than those in the untreated plots.
- (5) The effects of the three elements on size of kernel is comparable to their effects on yield.
- (6) The data for the three years are consistent and, on this basis, it would appear that a formula such as 4-18-4 applied at 1,000 pounds per acre would give satisfactory results for this crop.

### **Field Peas**

(T. C. Chiasson)

From the standpoint of climate, soil, and other requirements, field peas can be grown successfully in many parts of New Brunswick. Satisfactory yields can be obtained as is indicated by the five-year average yield of two named varieties tested at Fredericton during the past five years, namely, Valley and Chancellor with 54.8 and 54.3 bushels per acre, respectively. Several unnamed strains have far exceeded these yields. Growing of field peas as a cash crop seems to have been strictly limited by marketing rather than by cultural difficulties. Recent investigations indicate that high quality peas for boiling may be produced in this area. Intensified investigations are under way to determine the possibilities of this market.

### **Linseed Flax**

A test of linseed flax varieties was conducted for the three-year period, 1954-1956, to determine the adaptability of the crop to this area as well as the most suitable varieties. The highest yielding variety tested was Raja. It gave an average yield of 22.6 bushels per acre and required an average of 103.3 days to mature.

The above results indicate that linseed flax can be grown satisfactorily in this area from the standpoint of maturity. When prevailing prices and distances from markets are considered, it is doubtful that it would be a profitable crop for New Brunswick.

### **Soybeans for Seed**

Soybean varieties and strains were tested for seed production during the past five years. In this period late maturing varieties failed to ripen seed two out of five years. Early maturing varieties ripened seed each year. Acme, one of the earliest maturing varieties, produced an average of 23.3 bushels per acre and required an average of 129.0 days to ripen. This yield was obtained when the crop was grown in cultivated rows. The expense of growing soybeans as a cultivated crop, the relatively low yield per acre, and the risk of growing the crop in areas where the frost-free season is short preclude the profitable production of this crop in New Brunswick.

### **Hay**

#### **Red Clover Varieties**

Six varieties of double-cut and five varieties of single-cut red clover were tested for hay production for the three-year period 1954 to 1956.

In the test of double-cut varieties only minor differences in yield were obtained between the four highest yielding varieties, LaSalle, Dollard, Ottawa, and Redon. Average yields of dry matter per acre for the above varieties were 3.13, 3.13, 3.09, and 3.04 tons per acre, respectively. The varieties Commercial and Kenland were lower yielding with average yields of 2.90 and 2.71 tons per acre, respectively.

Winterkilling was relatively slight during the period of this test, ranging from 10 per cent for the variety Ottawa to 22 per cent for the Commercial variety.

The single-cut varieties tested included Manhardy, Altaswede, S-123, Leon, and Thomas. The yields of dry matter per acre, in that order, were 2.26, 2.25, 2.23, 2.21, and 2.05 tons. The smaller yields from the single-cut varieties,

compared with the double-cut, are chiefly because the former produces only one crop per year while the latter generally produces two crops. If only the first crop is considered, yields from the two types are approximately equal. One justification for seeding a single-cut variety is the fact that it blooms approximately a month later than a double-cut type. The former can thus be harvested in late July or early August and still provide good quality hay.

The differences in yield between the four highest yielding varieties were very slight. Thomas yielded slightly less than other varieties but had less winterkilling. This could prove advantageous when winterkilling is more severe than it was during this period. Thomas is a strain of single-cut red clover that has been grown on a Carleton county farm for over eighty years. Selection work is under way in an attempt to develop a higher yielding strain.

## Pastures

### Grasses and Legumes for Pastures

#### *Fredericton (T. C. Chiasson)*

A test was seeded in 1953 with two major objectives: (a) to determine the relative value of some common grasses in association with ladino clover for New Brunswick pastures and (b) to determine the value of brome and orchard grass for pasture when sown at comparatively heavy rates.

#### *Belleisle Creek (E. A. Grant)*

This test was seeded in 1954 and in it five mixtures were compared in replicated plots on land that had been in long-term pasture. Annual applications of fertilizer were applied.

In both tests, yields were based on clippings taken frequently to simulate pasture conditions. At Belleisle the area was grazed.

The results of both tests are summarized as follows:

- (1) The highest yield at Fredericton (4,444 lb. dry matter) and the second highest at Belleisle Creek (4,948 lb. dry matter) were obtained with a mixture of 8 to 10 lb. Timothy and 2 lb. Ladino clover per acre. The second highest yielding mixture at Fredericton was timothy 8 lb., red clover 7 lb., and ladino 2 lb. (4,290 lb. dry matter), while at Belleisle Creek a mixture of timothy, red clover, and alsike gave the highest yield (5,110 lb. per acre dry matter).
- (2) Timothy was equal to, or superior to, brome and decidedly better than orchard grass where seeded with ladino clover.
- (3) Increased rates of seeding brome and orchard grass did not influence yields.
- (4) Ladino clover, sown with timothy, appears suitable for seeding down pastures in New Brunswick. It is one of the cheapest mixtures and when it survives the second winter it is much superior to other legumes tested. If winterkilling is severe all legumes kill out.
- (5) Bird's-foot trefoil appears to be a poor species either sown alone or with grasses for New Brunswick pastures.
- (6) After the third year native wild white clover and grasses generally replace seeded species on New Brunswick pastures.

## Pasture Fertilization and Management

(C. F. Everett)

### Permanent Pasture versus Pasture in a Crop Rotation

A cultural pasture experiment, initiated to determine the relative productivity of continuous pasture and crop rotation pasture, has not indicated any significant difference in yield of herbage from different treatments (see Table 14).

Whenever alfalfa was present in the crop rotation pastures, the second growth showed symptoms of potash deficiency.

Table 14.—PERMANENT PASTURE VERSUS PASTURE IN A CROP ROTATION,  
FREDERICTON, N.B.

Fertilizer treatment per acre, annually	Type of pasture	Yield of herbage expressed as dry matter, 1950-57	
		lb/acre	
400 lb. 3-15-6.....	Crop Rotation Pasture First year pasture..... Second year pasture..... Third year pasture..... Average*	4,719 4,253 4,384 4,468	
400 lb. 3-15-6.....	Permanent pasture—Reseeded 1950.....	4,851	
400 lb. 3-15-6.....	Permanent pasture—Since 1918.....	4,476	
400 lb. 0-15-6.....	Permanent pasture—Since 1918.....	4,785	
No fertilizer.....	Permanent pasture—Since 1918.....	2,337	

\*In-pasture years only. This does not include the seeding year.

### Sources of Nitrogen and Phosphorus for Permanent Pasture

An experiment was initiated in 1951 to compare two sources of rock phosphorus, African and Florida, and superphosphate, as well as two sources of nitrogen, calcium cyanamide and ammonium nitrate, for pasture production. Seven years results indicated no significant difference in yields (1) due to increased rates of rock phosphorus from 1,000 up to 2,000 pounds applied in 1951, (2) due to the sources of rock phosphate tested, nor (3) due to the sources of nitrogen used (Table 15).

TABLE 15.—COMPARISON OF THE EFFECT OF SOURCES OF NITROGEN AND  
SOURCES AND RATES OF PHOSPHORUS ON THE YIELD OF PERMANENT PASTURE

Treatment per acre	Average yield of dry matter per acre		Increase in yield over unfertilized check	
	1957 only	1951-57 7 years	1957 only	1951-57 7 years
	lb.	lb.	%	%
Unfertilized check.....	798	1,055	—	—
400 lb. of 3-15-6 annually.....	1,408	1,640	76	55
2,000 lb. Florida rock phosphate—1951 only.....	899	1,276	13	21
2,000 lb. Florida rock phosphate—1951 only + 400 lb. 3-15-6 each year.....	1,556	1,993	95	89
2,000 lb. Florida rock phosphate—1951 only + 400 lb. 3-0-6 each year.....	1,151	1,664	44	58
1,500 lb. Florida rock phosphate—1951 only.....	790	1,256	-1	19
1,000 lb. Florida rock phosphate—1951 only.....	858	1,382	8	29
2,000 lb. African rock phosphate—1951 only.....	872	1,376	9	30
2,000 lb. African rock phosphate—1951 only + 400 lb. 3-15-6 each year.....	1,462	2,017	83	91
2,000 lb. African rock phosphate—1951 only + 400 lb. 3-0-6 each year.....	1,304	1,885	63	79
400 lb. 6-15-6—each year—calcium cyanamide.....	1,520	1,989	90	89
400 lb. 6-15-6—each year—ammonium nitrate.....	1,594	2,020	100	92

### **Permanent Pasture Fertilization**

An experiment was started in 1950 on an old pasture sod (last seeded in 1918) comparing 36 fertilizer formulae each applied at 500 pounds per acre annually. The plots were arranged to test nitrogen (N) at 0, 15, and 30 pounds; phosphorus ( $P_2O_5$ ) at 0, 40, 80, and 120 pounds; and potash ( $K_2O$ ) at 0, 30, and 60 pounds per acre. The soil was a sandy loam, stony phase with a pH of 5.2. Briefly, the results for a 6-year period were as follows:

- (1) 90 per cent of the increase due to N occurred before the end of June.
- (2)  $P_2O_5$  produced the greatest increase in yield, especially in the early spring, followed by a levelling off during the summer and fall.
- (3) The greater part of the increase from  $K_2O$  occurred in midsummer.
- (4) The largest increases due to N and  $K_2O$  resulted from the highest rates used.
- (5) The application of 40 pounds of  $P_2O_5$  each year resulted in as high yields after 4 to 5 years as the highest rates of application.
- (6) Each of the elements nearly doubled the grass content of the sward, reduced weeds by 5 to 10 per cent and decreased moss from 20 per cent to 2 per cent.
- (7)  $P_2O_5$  and  $K_2O$  slightly increased the clover content while N at 30 pounds lowered the proportion of clover in the stand.

### **Effect of Early-Summer Application of Nitrogen**

An experiment started in 1955 has shown that nitrogen applied in early summer (late June or early July) to permanent pasture increased the yield of forage during July and August. With the phosphorus and potash applied in the spring the early summer application of nitrogen greatly improved or evened-out the seasonal distribution of the forage. Low rainfall during August of 1957 did not appreciably alter the increase in midsummer yield due to the early summer application of nitrogen.

### **Cultural Practice**

*(C. F. Everett)*

#### **Rate of Seeding Grain**

This experiment conducted over a seven-year period compared the following rates per acre: oats 1 to 4 bushels, wheat and barley 1 to 3 bushels. Beaver, Abegweit, and Fundy oat varieties were tested, as well as Fort and Charlottetown 80 barley, and Cascade and Acadia wheat.

The results are as follows:

- (1) No significant increases in yield are obtained by seeding oats above the 2-bushel rate and wheat and barley above 1.5 bushels per acre.
- (2) Cross seeding of oats (with half the rate at right angles to the other) does not increase yield or decrease lodging.
- (3) Higher rates of seeding oats increase lodging.
- (4) Higher rates of seeding oats tend to reduce the succeeding hay crop.
- (5) Low rates of seeding of either wheat or barley allow more weeds to develop.

## HORTICULTURAL CROPS

### Tree Fruits

(R. G. White)

#### **Variety Trials**

Some 107 named varieties and numbered selections of apples, plums, and pears have been under observation since 1952. Of these 61 are composed of young trees less than ten years old.

The results of these observations are used as the basis for recommendations to the fruit growers in New Brunswick as published in "Crop Variety Guide for the Atlantic Provinces".

#### **Stem Builders for Apple Trees**

The production of greater winter hardiness in apple trees has been under study at Fredericton since 1935. In this work the non-commercial winter hardy variety Antonovka has been top-grafted to nine desirable but less hardy dessert varieties and the resulting trees studied to establish their winter hardiness. This work has now progressed to a stage where some tangible results are evident.

A critical winter in 1947 greatly weakened and even killed standard nursery trees of several of the more tender varieties under study, whereas the same varieties grafted upon the Antonovka have, for the most part, been unharmed. By comparison, 25 standard nursery trees have since died from winter injury whereas only two top-grafted trees have actually been lost. There are admittedly some weak trees among the top-grafted group but the number of trees lost or weakened is much less for this group. This is particularly true of the border line varieties like Red Spy and Sandow. The details of these findings are presented in Table 16, which briefly illustrates the superiority of the trees with the compatible Antonovka trunks and scaffold branches.

Other work of this nature is in progress at off-station orchards. The trees at these orchards have grown well but have not experienced a critical winter to test their hardiness. The work at Fredericton strongly indicates the advantages of hardy tree building.

#### **Mulches for Apple Trees**

There are strong indications that softwood shavings are equally as effective as oat straw and superior to sawdust, as a mulch for mature apple trees.

Nine Cortland apple trees at Fredericton which are thirty-three years old have been mulched with various materials since 1944. Throughout that period, a six-inch layer of oat straw has been maintained under two trees, three trees have been kept mulched with six inches of shavings, two with sawdust to the same depth, and two trees have been left unmulched. The fertilizer treatment, with one exception, has been uniform throughout. A small amount of supplemental nitrogen was applied to the trees mulched with sawdust. Soil samples were taken from beneath each tree in 1944, just prior to the application of any mulch and again in 1956, the differences between the two sets of readings reflecting quite marked changes in pH, organic matter, and mineral content. The number of trees involved is unquestionably small but the results, presented in Tables 17 and 18, clearly indicate that shavings make a satisfactory mulch for apple trees.

TABLE 16.—COMPARISON OF STANDARD NURSERY TREES WITH THE SAME VARIETIES TOPIGRAFTED UPON THE HARDY STOCK ANTONOVKA 1953-1957

	Standard Nursery Trees				Trees with Antonovka Framework					
	Number Planted	Original Trees Living 1957	Average Trunk Diameter 1957	Average Annual Yield 1953-57	Condition of Trees 1957	Number Planted	Original Trees Living 1957	Average Trunk Diameter 1957	Average Annual Yield 1953-57	
Bancroft.....	6	*5	11.08	20.69 pecks	Good 3 good, 1 fair, 2 replants	6	6	9.09	22.63 pecks	All good
Edgar.....	6	*4	9.06	17.59	—	6	6	8.54	19.67	All good
Kendall.....	6	0	—	—	All dead	6	6	8.55	19.45 3 good, 2 fair, 1 poor	3 good, 2 fair, 1 poor
Lawfam.....	13	*7	9.47	21.31	6 good, 1 dying, 6 dead	6	6	8.65	24.56	All good
Linda.....	9	0	—	—	All dead	6	5	5.94	11.15	3 good, 3 poor to fair, 1 dead
Macoun.....	6	*5	7.92	23.21	4 good, 1 poor, 1 dead	6	6	8.12	26.02	All good
McIntosh.....	6	*5	9.84	25.39 (4 trees)	4 good, 1 with gall, 1 replant	6	*5	8.70	22.87	5 good originals, 1 replant
Red Spy.....	6	*1	1.63	2.77	1 fair, 5 dead	6	*4	8.07	16.14	4 good originals, 2 replants
Sandow.....	6	1	1.31	0.95	1 poor, 5 dead	6	5	8.17	18.17	5 good, 1 broken
	64	28				54	49			

25 trees winterkilled  
11 trees died from other causes  
3 trees lost from other causes

64

54

\*1 Standard Bancroft, 2 Edgar, 5 Lawfam, 1 Macoun, 1 McIntosh and 1 Red Spy have been lost from causes other than winter injury. Only 3 top-grafted trees have been lost in this way (1 McIntosh and 2 Red Spy).

TABLE 17.—YIELD, AVERAGE FRUIT SIZE, FRUIT COLOR AND TRUNK DIAMETERS OF CORTLAND TREES MULCHED WITH SAWDUST, SHAVINGS, AND OAT STRAW, 1945-1957

No. of Trees	Treatment	Average Annual Yield/tree	Average Fruit Size-1957	Fruit Color 1957	Trunk Diameter Increase 1944-57
		pecks	inches	%	inches
2	Oat Straw.....	39.43	2.94	75.4	3.84
3	Shavings.....	39.45	2.95	84.1	4.65
2	Sawdust.....	34.18	2.98	74.6	3.92
2	Control.....	34.69	2.99	80.7	4.30

TABLE 18.—INCREASE OR DECREASE OF pH, ORGANIC MATTER, NITROGEN, PHOSPHATE AND POTASSIUM LEVELS IN ORCHARD SOIL TREATED WITH VARIOUS MULCHES FOR 12 YEARS

—	pH	O.M. %	N. ppm.	P <sub>2</sub> O <sub>5</sub> ppm.	K. ppm.
Oat straw.....	-0.90	1.22	.05	128	17
Shavings.....	-1.00	1.77	.06	122	17
Sawdust.....	-1.40	2.69	.07	165	-17
Control.....	-1.00	0.44	.04	62	-30

### Apple Nutrition Studies

(W. B. Collins and R. G. White)

The apple nutrition work for the period covered in this report is comprised of three allied phases.

*Phase 1*—Work was started at Fredericton in 1951 to determine what quantity of a 12-5-7 fertilizer formula could be applied annually to mature 27-year-old McIntosh trees without materially lowering the color and keeping quality of the fruit. The treatments were so chosen as to supply the trees with 1.00, 1.50, 2.00, or 2.50 pounds of actual nitrogen (N) per tree.

Results to date indicate that in this orchard there appears to be no advantage in applying more 12-5-7 than will provide 1.50 pounds of actual nitrogen per tree. Larger amounts of this formula resulted in a decrease in fruit color and keeping quality.

*Phase 2*—Work was conducted in each of three grower orchards and consists of a comparison between a 12-5-7 fertilizer, a 9-5-7 fertilizer, and applications of ammonium nitrate alone. The 12-5-7 and 9-5-7 were applied at the rate of 1 pound per inch of trunk diameter; supplying from 0.80 to 1.20 pounds of nitrogen per tree; the ammonium nitrate was applied at rates supplying 1.00, 1.50, and 2.00 pounds of nitrogen per tree. The objective in this case was to find out whether the standard 9-5-7 formula supplies sufficient nitrogen at the above rate or if additional nitrogen is required.

The data from this series indicate that under the conditions that prevail in these orchards the 12-5-7 and 9-5-7 formulae do not provide sufficient nitrogen to the tree. It was only when ammonium nitrate was applied at rates supplying 1.50 and 2.00 pounds of N per tree that adequate levels were reached in the tree and a N:K ratio approaching the optimum of 1.25 was obtained. Adequate levels of potash were maintained in all trees in the test.

The findings under these two phases show that fertilizer applications to mature McIntosh apple trees should contain at least 1.50 pounds of actual N per tree.

*Phase 3*—Initiated in 1956 at the request of a local grower this experiment was designed to ascertain whether a non-productive block of 35-year-old McIntosh trees situated on a very shallow soil underlain with ledge could be brought back into profitable production. These trees had been in a poor condition for a number of years as evidenced by small, pale foliage, short annual growth, and poor crops. Eleven fertilizer treatments were applied annually to trees in four replicates. The treatments included varying rates of nitrogen alone and in combination with phosphorus and potash; varying amounts of potash and the use of boron and magnesium. This phase of the study has not been under way sufficiently long that significant conclusions can be drawn.

In all the above studies leaf samples have been taken on each tree in the test during July and tissue analyses completed. In the fall, fruit samples were taken from each tree and placed in cold storage. These were examined periodically throughout their storage life and physical and quality measurements were made.

The most outstanding result from all three series is the effect of the ratio of N to K in the tree on fruit color, size, and keeping quality. These data have been summarized in Table 19, and show that the optimum ratio for fruit color and size is between 1.13 and 1.25 while that for keeping quality may be a bit higher. Hill of the Central Experimental Farm has concluded that a ratio of 1.25 is about optimum for McIntosh in Ontario. It would seem that a similar figure may be employed for New Brunswick conditions.

TABLE 19.—THE N:K RATIO IN McINTOSH FOLIAGE AND ITS RELATION TO FRUIT CHARACTERISTICS

Fruit Character	N:K ratio range				
	0.87-0.99	1.00-1.12	1.13-1.25	1.26-1.38	1.39
Color (%).....	70.0	70.3	72.1	69.4	66.5
Size (inches diameter).....	2.79	2.82	2.87	2.84	2.84
Pressure Test*, December.....	12.4	12.4	12.5	12.7	12.3
Pressure Test, January.....	11.4	11.5	11.6	11.7	11.5
Pressure Test, February.....	10.9	10.9	11.0	11.2	10.9

\* Pressure per linea distance squared.

### Small Fruit Breeding

(W. B. Collins)

Since 1953 some 5,800 strawberry seedlings have been grown and examined. Of the selections made from this number and from previous crosses, 73 have been retained and are in various stages of advanced testing.

During this period also 34 promising raspberry seedlings were selected from the following five crosses and reciprocals: Ottawa  $\times$  Madawaska, Ottawa  $\times$  Muskoka, Ottawa  $\times$  Rideau, Ottawa  $\times$  Trent and Ottawa  $\times$  Tweed. These selections were set out in 36-foot rows in 1957 and will receive further evaluation as they come into fruiting.

*Note*—The reader is referred to the Progress Reports from the Horticultural Substation, McDonald's Corner, for further detail on small fruit investigations in New Brunswick.

## POTATOES

### Potato Breeding

(*L. C. Young, H. T. Davies and D. A. Young*)

The potato-breeding program is a co-operative project between the Science and Experimental Farms Services of the Canada Department of Agriculture. In general, the Experimental Farms Service assumes responsibility for the horticultural phases of the program, including the making of crosses, the production and multiplication of seedlings, and the assessing of the commercial value of all productions based upon a study of such factors as character of top, season of maturity, tuber type and appearance, yielding ability, and cooking and storage quality. The Science Service is responsible for the determination of the resistance of seedling productions to disease and insect pests. Assistance is also received from officials of the Plant Protection Division, Production Service, in the final evaluation of seedlings, prior to introduction.

The program is national in scope in that seedlings, originating at Fredericton, are tested throughout Canada, from Newfoundland to British Columbia. Co-operating in these trials are Experimental Farms and Illustration Stations in every province, as well as several Agricultural Colleges and Provincial Stations. These National Trials are under the supervision of the Horticulture Division, Central Experimental Farm, Ottawa.

*New Varieties Introduced*—To date, five varieties, Keswick, Canso, Huron, Avon, and Fundy have been considered worthy of introduction. The varieties Keswick and Canso were introduced in 1950, and reported in the 1948-1952 Progress Report for this Station. Huron was introduced in 1957, and Avon and Fundy are being released in 1958.

#### The HURON Variety

Huron, tested under the seedling number 1711-9, was produced in 1943 from a cross between the German variety Hindenburg and the U.S.D.A. variety Sebago. It was found to have a moderate degree of resistance to common scab, and was distributed for trial to Experimental Farms and other co-operating institutions in Canada. It has consistently performed well in the late potato-growing areas of Ontario and consequently was released in that province in 1957 as a new scab-resistant potato variety.

Although this variety appears to be best adapted to Ontario conditions, it may also find a place in other areas. It has been extensively tested in New Brunswick.

Huron is an extremely vigorous growing seedling with a very attractive top. The leaves are large and flat and it is easily rogued for virus diseases. It is a high-yielding variety, placing first for yield of marketable tubers in five out of six replicated yield trials in New Brunswick over a three-year period.

The dry matter content<sup>1</sup> of Huron is slightly higher than that of Katahdin. Average figures for a series of five yield trials are as follows: Green Mountain 19.0 per cent; Huron 18.0 per cent; and Katahdin 17.5 per cent of dry matter.

In cooking trials, Huron has been rated "good" for both boiling and baking in comparison with Green Mountain and Katahdin.

Summarizing, Huron is a late maturing, high yielding variety with average dry matter content and moderately high resistance to common scab. It has a serious weakness in that the tops mature very late, resembling Sebago in

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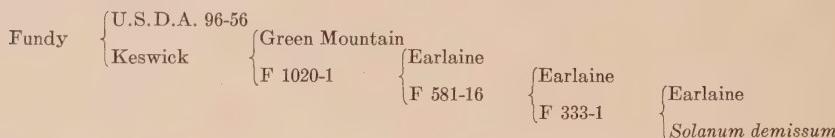
<sup>1</sup> All dry matter percentages determined with the "Bewell" Potato Hydrometer.

this respect. Fortunately, the tubers skin only slightly, even if harvested when the tops are still green. Some form of vine killing, either chemical or mechanical, will probably be necessary under large scale commercial growing operations in New Brunswick. This variety may also prove to have an important place with small farmers growing less than an acre of potatoes, particularly in areas where common scab is a serious problem.

### The FUNDY Potato

The Fundy potato originated from a cross between the Fredericton variety Keswick and the U.S.D.A. seedling 96-56.

The pedigree is as follows:



Fundy has been under test for eight years under the seedling number F503, and has been included in the Canada-wide Advanced National Trials for three years. It is being introduced and released to the public in 1958.

*Habit and General Appearance:* Medium height, slightly spreading, drooping, open, not bushy, slightly straggling, slightly branched (only occasional branch), medium vigor.

*Foliage:* Closed leaf. This feature is apparent only on lower leaves that have no roll. The tendency of this seedling is for the leaves to have a slight to pronounced rim roll, depending on the degree of maturity. When this roll is present, the leaf appears open. Midrib lacks coloration other than green. Leaf dark green, slightly wrinkled, glossy, medium length, drooping side leaflets arched. Leaflets large, broad, thick, terminal pair of leaflets slightly overlap terminal leaflet, leaflet stalk medium to long, secondary leaflets present, terminal leaflet drooping, not joined to adjacent side leaflets.

*Stem:* No coloring present other than green, thick, wings straight or very slightly waved. Stem hollow between joints.

*Flowers:* White. Rather sparse. Anthers yellow. Style long, stigma green, bi-lobed. Flower stalk arises well down stem, consequently blossoms do not stand up above top of plant to any extent. Buds green, bud base dark green, distinctly hairy. Buds persistent.

Flower stalk short to medium length, thin, hairy, light green color, no leaves on flower stalks. No production of seed balls.

*Tubers:* Elliptical, medium thick, mean length 3.37 inches, mean width 3.00 inches, mean thickness 2.25 inches. Skin smooth, dark cream buff, slightly netted. Eyes shallow, same color as skin. Eyebrow long, curved, prominent. Flesh white.

*General Description:* The plants are of medium height with a slightly spreading habit and are moderately vigorous. The maturity is early to mid-season. The flowers are white and rather sparse. The leaves have a slight to pronounced tendency to rim roll as maturity advances. The tuber is smooth, slightly netted, shallow eyed, elliptical, medium thick, of excellent type and very attractive in appearance.

In seven replicated yield trials over a three-year period it averaged 467.2 bushels per acre of marketable tubers testing 17.2 per cent dry matter compared with 444.7 bushels per acre testing 17.0 per cent dry matter for Katahdin.

Fundy has been included in cooking trials for five years and averaged 85 and 89 scores for boiling and baking respectively compared with 81 and 82 for Green Mountain, and 77 and 82 for Katahdin.

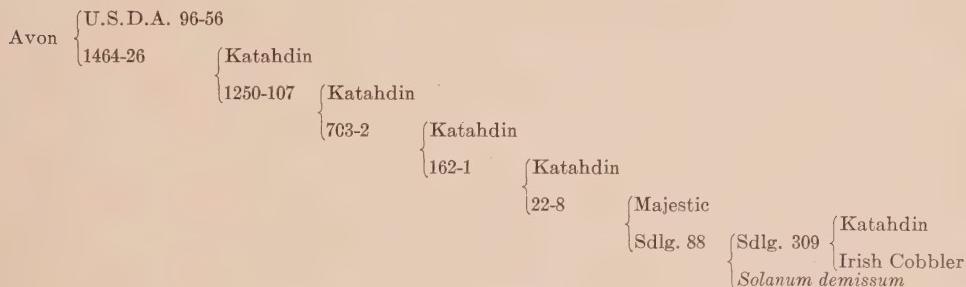
It is of the genotype R1 and is resistant to the common race of late blight. It is susceptible to viruses X, Y, and A but top necrotic to virus B.

The outstanding characteristics of this variety are its earliness combined with a smooth tuber and its high cooking quality. As an early it is superior to Irish Cobbler for smoothness of tuber and keeping quality. As a main crop, it is equal to Green Mountain or Netted Gem and superior to Katahdin and Sebago in cooking quality. It is a slightly higher yielding variety than Katahdin.

### The AVON Potato

The Avon potato has been under observation in New Brunswick for eleven years and has been tested extensively under the number F4713 in the Maritime Provinces and also throughout Canada in the national system of trials.

The cross from which Avon was selected was made in the greenhouse at Fredericton in 1946, and the seedling was first grown in the field in 1947. The pedigree is as follows:



*Habit and General Appearance:* Height short to medium, spreading, open type, stems branching, medium vigor.

*Foliage:* Leaf closed, midrib pale green, leaf dark green, dull, waxy, medium length, drooping, side leaflets arched. Leaflets small, broad, terminal pair leaflets do not overlap terminal leaflet, leaflet petiole short with tiny leaflets at base. Terminal leaflet drooping, not joined to either of side leaflets, secondary leaflets present between pairs of primary leaflets. Tertiary leaflets also present.

*Stem:* Tinged with reddish-green. Average thickness, branching, wings waved.

*Flower:* White, plentiful, anthers orange, loose, or spaced. Style short; buds green with darkened area at base, persistent; stalk green, darker on one side, hairy, of average length; occasional seed ball formed in field.

*Tubers:* Medium size, short oblong, thick. Mean length 3.25 inches, mean width 3.06 inches, mean thickness 2.36 inches. Skin dark cream buff, smooth. Eyes medium depth, same color as skin, apical eyes depressed. Eyebrows medium long, inconspicuous, curved. Flesh white.

*General Description:* In maturity, Avon is considered slightly earlier than Green Mountain and Katahdin in New Brunswick. The top is compact, bushy, and of medium vigor. The tubers are of good size and of uniform type. The eyes are moderately deep and as grown under certain conditions the eyes of the larger tubers may be very deep, approaching Irish Cobbler in this respect. This definite weakness of the variety is partially offset because the uniformity

of the tubers makes the crop attractive. Hollow heart has been found upon occasion in the over-sized tubers in some areas and in certain seasons.

The yield is superior to Katahdin and the dry matter content of the tubers is average. This seedling was included in replicated yield trials at two locations in New Brunswick over a five-year period. On an average, based on nine trials Avon yielded 456.1 bushels of marketable potatoes per acre as compared with 406.8 bushels for the variety Katahdin and 502.6 bushels for Green Mountain. In the same trials, the average percentage dry matter for Avon was 18.0 as compared with 17.6 for Katahdin and 19.3 for Green Mountain.

Avon was also included in the Advanced National Trials at Fredericton for the three-year period, 1955-57 inclusive. The yield of marketable tubers in bushels per acre was 440 as compared with 369 for Katahdin and 493 for Green Mountain. The percentage dry matter was as follows—Avon 18.1, Katahdin 18.3, and Green Mountain 20.2.

*Disease Resistance:* Avon carries the gene R1 for resistance to late blight. In this respect, it is in the same category as such varieties as Keswick, Canso, and Kennebec. It is susceptible to viruses A, X and Y and top-necrotic to virus B. It has a high degree of resistance to common scab as compared with the susceptible variety Green Mountain. Its resistance is less than the varieties Menominee, Cherokee, and Ontario, but about equal to that of the variety Huron.

*Cooking Trials:* Avon has rated excellent in cooking quality over a six-year period at Fredericton. On the basis of seven tests, Avon scored 88.4 when boiled as compared with 78.7 for Katahdin and 82.4 for Green Mountain. When baked, the scores were 86.4 for Avon, 76.5 for Katahdin, and 78.8 for Green Mountain.

*Chipping Trials:* Chipping tests have been conducted over a two-year period. It has made a satisfactory chip in late August, when chipped immediately after early harvesting and also in February, when brought in from common storage at 40°F and reconditioned for three to four weeks at 75°F. It also chipped well in Nova Scotia, when processed in the fall immediately following harvesting. There is a great need in this province for a chipping variety that matures after Irish Cobbler, and Avon should fill this gap.

It is to be released in 1958 as a scab-resistant fall chipping variety for Nova Scotia.

## Related Research

### Chipping Trials

The importance of the potato chip industry in Canada is increasing every year, and as a result there is a great demand from the trade for varieties that will make a high quality product. Some varieties are seldom suitable for chipping purposes; other varieties are nearly always dependable when properly handled. This also applies to potential new varieties that are still in the seedling stage.

For the last two years, chipping tests have been conducted with tubers from all seedlings that have survived three years of field trials at Alma. The objective of these trials is to find out which seedlings will make good chips in late summer and fall and will recondition satisfactorily and in the shortest time during the winter, when removed from common storage.

### Potato Yield Trials

As part of the National Potato Breeding Project, yield trials have been conducted for many years at the McDonald's Corner Horticultural Substation

and at various other locations in the province to assist in the evaluation of seedlings. Data on the trials at McDonald's Corner are presented in the progress report from that Station.

**Salmonhurst Yield Test:** To evaluate promising seedlings in typical potato growing regions, yield trials have been conducted at Salmonhurst in Victoria County since 1946. It has been the practice to test the most promising blight- and scab-resistant seedlings, including those in the Advanced National Trials, also the check varieties Green Mountain, Katahdin, and Keswick. For the period 1953 to 1957 Green Mountain averaged 553 bushels per acre marketable tubers testing 17.9 per cent dry matter, Katahdin 463.0 bushels per acre testing 16.9 per cent dry matter, and Keswick 521.2 bushels per acre testing 17.4 per cent dry matter.

Only one seedling, F4713 was in the trials for five years. It averaged 510 bushels per acre testing 17.2 per cent dry matter. This seedling is to be named and introduced in 1958 and is fully reported elsewhere. F4631, another seedling that has shown considerable promise in the Advanced National Trials, averaged 544 bushels per acre testing 16.6 per cent dry matter for a four-year period. F4932, which is to be advanced to the National Trials in 1958, yielded at the rate of 509.1 bushels per acre testing 17.0 per cent dry matter for a four-year period. F4724, which was mentioned because of its scab resistance, averaged 444.4 bushels per acre testing 18.4 per cent dry matter over a two-year period. Other seedlings have been in the test for only a limited time and require further evaluation.

#### New Source of Resistance to Common Scab

The German varieties Hindenburg, Richter's Jubel, and Arnica have been used extensively for many years by potato breeders as a source of scab resistance. These varieties have a serious shortcoming in that they are susceptible to internal necrosis and this susceptibility appears to be linked with scab resistance. Moreover, they are late in season, and produce an inferior crop of tubers.

Fredericton seedling F4724, derived from the cross U.S.D.A. 96-56 by Sebago, in addition to being resistant to the common race of late blight, has also been found to be highly resistant to common scab. Field and greenhouse trials have shown that this seedling is not susceptible to internal necrosis, and that it passes a high degree of scab resistance to its progeny. Of 91 progeny tested, 49 showed resistance equivalent to that of Russet Burbank while 9 possessed resistance comparable to that of Hindenburg. Moreover, the yield of marketable tubers is good and the cooking quality excellent. This evidence indicates that F4724 offers to breeders a new source of scab resistance superior to that presently available.

#### Field Resistance to Late Blight

A group of 299 seedlings and 16 varieties in a replicated field trial were inoculated with race 1, 3, 4 of the organism using a portable low pressure sprayer. Ninety-four of the seedlings displayed resistance in varying degree. The varieties Hindenberg, Richter's Jubel, U.S.D.A. 96-56, U.S.D.A. 46952, and President appeared frequently in the parentage of the resistant seedlings. Voran was the most resistant variety, with Parnassia, Alpha, President, Noordeling, Ackersegen, Hindenburg, and Sebago following in descending order.

In a replicated field trial designed to study the effect of maturity upon resistance, 12 seedlings and varieties were planted on five dates over a period of 40 days. Young plants were more resistant than mature plants of the same variety. As the young plants became more mature they approached the level

of susceptibility of the earlier plantings. Resistant varieties showed a narrower range of susceptibility between dates of planting than susceptible varieties. The difficulty of assessing resistance in field plots was emphasized.

A modification in field trials is suggested. Test varieties should be planted in blocks according to maturity or, preferably, plantings should be at different dates, so that all varieties will be at approximately the same stage of physiological development at the time of exposure to the organism.

#### **Major Gene Resistance to Late Blight**

Considerable progress has been made in producing seedlings with a known genotype, in respect to the four major genes for blight resistance R1, R2, R3, R4.

Commercial type seedlings with two and even three genes for resistance are under observation. Moreover, several seedlings, carrying all four genes and derived from commercial-type parents on both sides, have been produced. These seedlings are in the small tuber, greenhouse stage, and hence have not been evaluated under field conditions. However, in view of the parentage, they should produce tubers of commercial size.

If future tests substantiate the genotype of these seedlings, this will constitute a distinct step forward, since all previous productions with a R1, R2, R3, R4 genotype have been wild in character and produced a crop of small, worthless tubers.

### **Fertilizer Requirements for Potatoes**

A number of tests have been conducted, both at Fredericton and on Illustration Stations, in an attempt to determine the macro-nutrient requirements for potatoes in New Brunswick.

#### **Fertilizer Formula for Potatoes (E. A. Grant)**

This study was begun in 1953 on Illustration Stations at East Centreville and Salmonhurst. Its objective is to determine the most satisfactory levels of actual nitrogen (N), phosphorus ( $P_2O_5$ ) and potassium ( $K_2O$ ) when applied without manure to potatoes. The two major soil types in the commercial potato growing area were represented in the test, namely, Caribou loam at East Centreville and Holmesville loam at Salmonhurst. The experiment is being conducted in a three-year rotation of potatoes—oats—clover.

*Summary of Results:* Potato yields were increased by the application of N up to 120 pounds per acre. In most instances the application of 180 pounds depressed yields. This yield pattern was evident at both East Centreville and Salmonhurst.

Yield response to  $P_2O_5$  was evident up to 200 pounds per acre at East Centreville. At Salmonhurst, however, a significant response was observed up to 300 pounds.

There was no significant yield response beyond the 100 pound level of  $K_2O$  except for one season 1956, when there was a response up to 300 pounds per acre. In five out of the ten tests the 300 pound level depressed yields.

All the fertilizer elements studied affected the total solids content of potatoes. N and  $P_2O_5$  did not affect it significantly but with every increase in the level of  $K_2O$  applied there was a corresponding significant decrease in the total solid content. This is an important factor in terms of potato quality.

#### **Effect of Potassium on Potato Quality (A. A. MacLean and J. J. Doyle)**

This trial conducted from 1953 to 1956 was designed to study the effect of different potassium salts on the quality and yield of potatoes. Quality was

evaluated on the basis of the dry matter content of the tubers. Chemical analysis was made on the petiole tissue to study the effects of rates of application of potassium salts on the uptake of certain elements and in turn the relationship of nutrient level in the tissue to yield and dry matter content. The results of the study are shown in Table 20.

Potassium sulphate gave a higher dry matter content and slightly higher yields than potassium chloride. However neither source of potassium reduced the dry matter content significantly unless used at excessive rates.

The potassium content of the tissue increased with rates of application of either salt. The chloride content increased with rates applied of potassium chloride. The slightly higher content of chloride in the petiole tissue of potato plants from the sulphate plots than from the untreated plots may be the result of impurities in the sulphate salt.

The phosphorus content shows a decline with increasing rates of application and uptake of potassium.

TABLE 20.—EFFECT OF RATES AND SOURCES OF POTASSIUM ON QUALITY AND YIELD OF POTATOES AND ON NUTRIENT CONTENT OF PETIOLE TISSUE

(Averages for 1953-1956)

Treatment K <sub>2</sub> O Lb./Acre	Potassium Content ppm.	Chloride Content ppm.	Phosphorus (P) Content ppm.	Yield Bu./Acre	Percentage Dry Matter
0.....	1,581	744	56	167	18.1
<i>KCl</i>					
80.....	3,711	1,796	34	289	18.0
160.....	5,243	2,355	29	307	17.5
240.....	6,046	3,029	34	277	17.3
320.....	6,726	3,364	23	281	17.0
<i>K<sub>2</sub>SO<sub>4</sub></i>					
80.....	4,002	740	31	294	18.8
160.....	4,680	912	24	331	18.5
240.....	5,874	980	26	295	18.2
320.....	6,353	966	18	288	17.9

From these data and from data obtained in studies of fertilizer requirements it is concluded that the optimum concentration of potassium in potato petiole tissue is in the vicinity of 4,500 p.p.m.

The information gained from the above two projects, and from similar experiments conducted in previous years, formed the basis for the recommendation of a 6-12-8 fertilizer formula for potatoes. This was adopted by the Maritime Fertilizer Council in 1956.

#### Foliar Application of Nitrogen (A. A. MacLean, J. J. Doyle)

This investigation was prompted by the fact that in 1954 "Nugreen" (a form of urea containing 45 per cent nitrogen) was offered for sale for use in the foliar application of nitrogen to potatoes. In a field trial ammonium nitrate was applied as a soil treatment, at time of seeding, at rates supplying 0, 30, 60, 90, and 120 pounds of nitrogen per acre.

"Nu-green" was applied in five separate sprays to supply totals of 0, 30, 60, and 90 pounds of nitrogen per acre in a factorial arrangement with the ammonium nitrate nitrogen. The sprays were applied at nine-day intervals beginning at forty days after planting. The yields for 1955 are shown in Table 21.

Since some burning of the foliage was observed, particularly at high rates of Nu-green, and since the response to soil applications of nitrogen was not

TABLE 21.—EFFECT OF FOLIAR VERSUS SOIL APPLICATION OF NITROGEN ON YIELD OF POTATOES (Bu./Acre)

Nu-green lb. N/acre	Ammonium Nitrate—lb. N/Acre					
	0	30	60	90	120	Average
0.....	363.8	391.0	386.7	401.0	368.8	382.2
30.....	396.0	396.0	394.5	385.2	366.7	370.4
60.....	281.9	352.0	336.0	354.6	361.7	337.3
90.....	236.8	333.2	323.2	314.6	309.6	303.3
Averages.....	298.1	368.1	360.1	363.8	351.7	

L.S.D. (.05) for average ammonium nitrate yields = 18.0 Bu/A.

L.S.D. (.05) for average Nu-green yields = 16.1 Bu/A.

very large, the trial was repeated at a new location in 1956 using lower rates and a smaller number of increments of Nu-green. The 1956 results showed a very marked response to soil applications of nitrogen and there was no burning of the foliage but the crop failed to respond to foliar applications of nitrogen. Foliar application of urea is therefore not recommended as a standard practice for potatoes.

#### Long-Term Effects of Fertilizers and Rotations on Yields (*A. A. MacLean, J. J. Doyle*)

Since 1931 a project has been in operation to study the long-term effect of rates of fertilizer and of manure plus fertilizer on yields of potatoes; and to compare yields on areas planted to potatoes annually with those from a potato—grain—hay rotation.

Comparison of the 27-year average and the first 4-year average shows that yields have declined regardless of treatment or cultural practice. The highest long-term average yields have resulted from the three-year rotation, and from continuous cropping with manure and fertilizer annually.

#### Effect of Ca/K Ratio on Incidence of Scab (*A. A. MacLean and J. J. Doyle*)

The effect of Ca/K ratio in the soil on the incidence and severity of potato scab was investigated in the greenhouse. Four rates of calcium hydroxide and of calcium sulphate were applied to the soil in a split-plot factorial arrangement with five rates of potassium chloride.

In addition to this investigation, analyses were conducted on soils selected from potato fields representing a wide range of severity of infestation.

It was concluded from the data that the Ca/K ratios ordinarily encountered in the soil have little if any bearing on the incidence of scab and that pH is the most important single factor influencing the severity of attack by this organism.

#### Fungicidal Control of Potato Scab (*A. A. MacLean and J. J. Doyle*)

An experimental fungicide, pentachloro nitrobenzene (PCNB), has been suggested by the manufacturer as a control for potato scab. An experiment to study this material was conducted in the greenhouse in 1954. A soil heavily infested with the scab organism was treated with this chemical and planted to Green Mountain potatoes. The results of the test shown in Table 22 indicate that this is a method of control that merits further investigation.

TABLE 22.—EFFECT OF PCNB ON INCIDENCE OF POTATO SCAB

Treatment	Scab lesions per kilogram
0	250
50 lb. PCNB/acre.....	60
150 lb. PCNB/acre.....	1
250 lb. PCNB/acre.....	0

**Effects of Peat on the Yield of Potatoes (E. A. Grant and J. E. Comeau)**

This study was begun in the fall of 1947 at the Siegas Illustration Station. Wet peat was applied to  $\frac{1}{4}$ -acre strips at 20 tons per acre and 40 tons per acre, a third strip received manure at 20 tons per acre, while the remaining strip was left untreated.

Potatoes were planted in 1948; this crop was followed by grain and two years hay. In 1951 treatments were repeated and potatoes planted in 1952 and again in 1953. The plot area was in grain in 1954 and clover in 1955. In the fall of 1955 treatments were repeated again and potatoes grown in 1956. In addition to the above treatments a uniform application of 2,000 lb. of chemical fertilizer, 4-8-10 in 1948, 6-9-9-1 in 1952 and 1953, and 6-12-12 in 1956 was applied to all plots. The results are briefly summarized in Table 23.

TABLE 23.—YIELD OF POTATOES IN Bu./Acre

Treatment	1948	1952	1953	1956	Average
Check.....	386.3	250.2	295.3	435.5	341.8
20 Tons peat/acre.....	393.4	300.7	307.2	430.4	357.9
40 Tons peat/acre.....	430.1	324.9	345.1	487.3	396.9
20 Tons manure/acre.....	448.5	323.1	280.1	514.6	391.6

The averages show a trend that was consistent throughout the test. Peat and manure can improve potato yields even in the presence of adequate chemical fertilizer applications. The results indicate that peat is about half as effective as farm manure.

The use of peat and manure will, however, be dependent upon factors such as availability, distance of hauling, and cost of application.

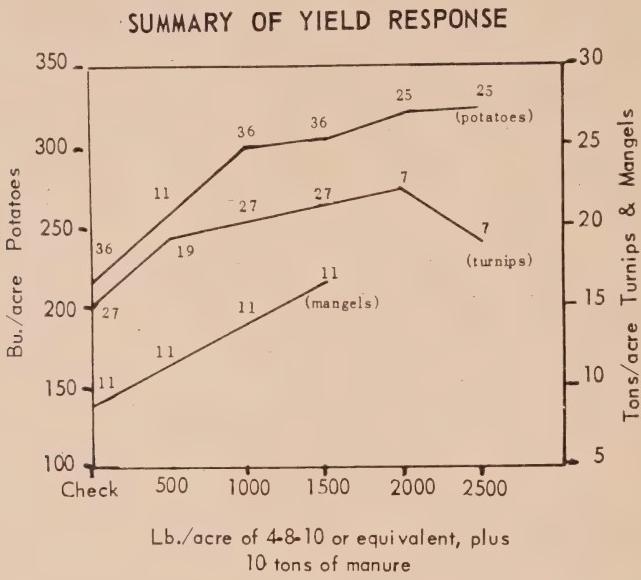
**Chemical Fertilizer as a Supplement to Farm Manure**

(E. A. Grant and J. E. Comeau)

This study was conducted at the Illustration Station at St. Quentin to determine the fertilizer level required for potatoes grown with 8 to 10 tons of manure per acre. The experiment was conducted in a four-year rotation of root crop—cereal—hay—hay. N was applied at 45, 90, and 135 lb.; P<sub>2</sub>O<sub>5</sub> at 100, 180, and 240 lb. and K<sub>2</sub>O at 75, 150, and 225 lb. per acre and compared in all possible combinations.

No significant yield response from levels higher than 45 lb. of N, 120 lb. of P<sub>2</sub>O<sub>5</sub>, and 75 lb. of K<sub>2</sub>O was observed over a five-year period. There was, however, a significant decrease in the dry matter content of the potatoes for every increased application of K<sub>2</sub>O.

The rates suggested in this experiment are further substantiated by a long-term experiment on rates of fertilizer applications conducted on a number of stations since 1938. At the inception of this test a 4-8-10 formula was used but over the years it was adjusted to current recommendation. In Figure 1, the long-term yield records for potatoes, turnips, and mangels are presented graphically.



(Figures above graph line indicate the number of tests)

Figure 1

The results indicate that the following rates of a complete formula are the most economical when used with manure at 8 to 10 tons per acre: potatoes, 1,000 lb.; turnips 500 lb.; and mangels 1,500 lb. per acre.

The results of both experiments suggest that when growing potatoes with 8 to 10 tons of manure, 800 to 1,000 lb. per acre of 6-12-8 are sufficient to give satisfactory yields.

### Potato Cultivation Necessary with Herbicides

(C. F. Everett)

The use of herbicides for weed control in potatoes has made necessary a re-examination of cultivation practices. A comparison of the number of cultivations required was carried out at Fredericton on a sandy loam soil over a three-year period. Broad-leaved annual weeds were controlled with 3 to 3.6 pounds (active ingredient) per acre of DNBP amine applied when 5 per cent of the Keswick potato sprouts had emerged.

Following is a summary of the results:

- (1) One cultivation and hilling during the early growing period was necessary to obtain maximum yields. This should be done four to five days before applying the herbicide.
- (2) The above, plus one (or not more than two) moderate hillings before bloom to build a low, wide, slightly concave-topped hill was sufficient to control broad-leaved annual weeds and prevent excessive sunburn.

However, when couch grass or annual grasses are present in quantity, additional cultivations or grass-controlling herbicides are required. When more than three cultivations were made, yields decreased with each additional cultivation. This decrease in yield appeared to be associated with deep cultivation to provide soil for a large hill.

### **Vegetables**

(R. G. White)

Vegetable production in New Brunswick is limited in scope, with some 1,265 acres of crops being recorded in the 1951 census. On this acreage thirteen listed vegetables and others not named are grown. More recently some 900 additional acres of land have been seeded to peas for the frozen pea industry.

The vegetable work at the Fredericton Farm has consisted chiefly of variety trials of those vegetables that are either being grown commercially or have commercial possibilities with some recently initiated work on cultural practices. About 320 varieties or strains have been under observation during the past five years, the results of the work are used in compiling variety recommendations, published in the bulletin "Crop Variety Guide for the Atlantic Provinces". This publication is revised every two years.

*Note*—Further details on vegetable trials are reported in the Progress Report for the Horticultural Substation, McDonald's Corner.

### **Ornamentals**

(R. G. White)

Considerable time is spent in maintaining the ornamental plantings at the Fredericton Experimental Farm. Concurrent with this work various varieties of annual flowers, roses, and other plants are grown and their adaptation to the area studied. A number of those grown have been outstanding in their performance. Information may be obtained by writing to this Farm.

#### **Gladiolus Cultural Trial**

Limited study with gladioli bulbs has resulted in the following observations, based upon the flower spike:

- (a) There was a slight but non-significant advantage in covering the planted bulbs gradually, regardless of whether they were planted four, six, or eight inches deep. The initial covering in all cases was two inches.
- (b) A corm 1 inch in diameter seemed equally good for planting as a corm  $1\frac{1}{2}$  inches, or larger. Corms smaller than this were too late coming into bloom.
- (c) Whole bulbs were superior to bulbs cut in half except that cutting the bulbs increased the number of blooms produced. Cutting bulbs into three pieces resulted in more blooms, but weak growth.
- (d) Extra phosphorus seemed of little value in improving the flower spike or in increasing the number of corms produced.
- (e) Blooms cut with 5 florets open were slightly superior to blooms cut with from one to four florets open. Uncut bloom greatly weakened the corms for future planting.

A test garden is operated for the Canadian Gladiolus Growers Council. Five such gardens are maintained across Canada and are instrumental in sifting out poor seedlings before they are put on the market as named varieties.

## SOIL FERTILITY

*(A. A. MacLean, J. J. Doyle)*

This section of the report presents data from studies of more than one crop in a rotation, and also findings from more fundamental research on various aspects of plant nutrition.

### Fertilizer requirements for oats and hay

A long-term investigation designed to compare manure and commercial fertilizer as treatments in a 4-year rotation (oats + 3 years in hay) was started in 1924. The results of the 28-year study are shown in Table 24.

TABLE 24.—MANURE VERSUS COMMERCIAL FERTILIZER FOR HAY AND OATS

Treatment/acre	Yields (28-year average)	
	Oats Bu./Acre	Hay T/Acre
8 tons manure on the first and third hay crops.....	51.0	1.6
8 tons manure on the first and third hay crops plus 600 lb. 4-12-6 for oats	62.5	1.9
200 lb. 8-10-8 on first, second, and third hay crops.....	46.7	1.2
400 lb. 4-12-10 for oats plus 400 lb. 2-12-6 for hay plus 400 lb. 4-12-6 for second hay crop plus 100 lb. ammonium nitrate annually.....	61.2	1.9
Check—no treatment.....	37.2	0.6

It is concluded that at the rates used manure is equal to fertilizer in maintaining yields of hay and that the most economical practice is the application of commercial fertilizer to the grain crop plus applications of manure to the hay crop.

### Macro-Nutrients

#### Phosphorus and Potassium

In 1952 an investigation was initiated to assess the phosphorus and potassium supplies in surface samples of a number of soil types in New Brunswick. One objective was to correlate chemical tests with crop response to applied fertilizer in greenhouse trials. The results of this investigation were published in the following scientific papers:

Fertility studies on some New Brunswick soils. I. Soil phosphorus supply as shown by greenhouse and chemical tests. MacLean, A. A., J. J. Doyle, and F. G. Hamlyn. Can. J. Agr. Sci. 35: 388-396. 1955. II. Soil potassium supply as shown by greenhouse and chemical tests. MacLean, A. A., J. J. Doyle, and F. G. Hamlyn. Can. J. Soil Sci. 37: 29-33. 1957.

#### Residual Effects of High Rates of Fertilizer

In areas of concentrated agriculture such as potato growing districts where high rates of fertilizer are used it is desirable to have information regarding the accumulation of applied fertilizer elements and their residual effects. To obtain this information a project was initiated in 1954. For this purpose soils that had been cropped annually to potatoes since 1931, with annual treatments, were analyzed for total phosphorus and for exchangeable potassium. Table 25 shows the effect of the different fertilizer treatments on the accumulation of these two elements.

TABLE 25.—EFFECT OF LONG-TERM FERTILIZER TREATMENTS ON ACCUMULATION OF PHOSPHORUS AND POTASSIUM AT VARYING DEPTHS IN THE SOIL  
(Data are for total P and Exchangeable K, in p.p.m.)

Depth (Inches)	Treatment per acre									
	1,600 lb. 5-10-13		800 lb. 5-10-13		Check		16 tons manure		800 lb. 5-10-13 + 16T Manure	
	P	K	P	K	P	K	P	K	P	K
0-6.....	692	198	609	150	412	46	628	247	797	341
6-9.....	373	77	333	85	339	43	510	138	641	236
9-12.....	309	78	238	55	206	28	307	44	276	111
12-15.....	285	63	230	50	251	32	286	35	238	104
15-21.....	282	62	294	34	256	33	289	30	303	68
21-27.....	280	32	253	21	265	25	259	33	266	32

The data show that there is considerable accumulation of both phosphorus and potassium and that most of this accumulation occurs above the 12- to 15-inch depth.

To obtain data regarding the availability of the accumulated fertilizer to plants, a greenhouse test was started in which ladino clover was grown as an indicator crop. Yield data obtained to date indicate that there is a considerable residual effect from the accumulated fertilizers. On completion of chemical analysis of the plant material a more comprehensive report will be made on the ability of these soils to supply phosphorus and potassium.

### Micro-Nutrients

#### Molybdenum

In 1954 a greenhouse project conducted on a Carleton loam soil showed a small but significant response of ladino clover to molybdenum. In order to cover a wider range of soils a second project was conducted in 1955. In this project thirteen soils selected over a large area in the province were treated with molybdenum and planted to ladino clover. On the basis of mean values for the thirteen soils a significant increase resulted from molybdenum, with most of this increase occurring in the first cut and no increase in the third cut.

Determinations of total molybdenum and water-soluble molybdenum in the untreated soil showed no relationship between soil molybdenum and response to applications of this element. Applications of molybdenum to the soil increased the molybdenum content of the plant even where there was no crop response.

#### Boron

Applications of boron are required for the satisfactory production of certain crops such as apples and swedes on New Brunswick soils. It is quite likely therefore that liming which is required for the satisfactory production of forage crops may induce a boron deficiency. In order to study this possibility a project was started in the greenhouse in 1957. An acid soil was limed to seven pH levels in a factorial arrangement with four rates of boron. Ladino clover was planted as an indicator crop.

The yields for three cuts show a significant response to both lime and boron. There is, however, no lime  $\times$  boron interaction, which indicates that lime in this case did not induce a boron deficiency. A more comprehensive report will be made, on the completion of chemical analysis of the plant material.

## Fertilizers and Other Amendments

### Rock Phosphate

Suggestion of the possibility of partially satisfying the phosphorus-fixing capacity of acid soils and of building up a reserve of phosphorus in the soil through the application of raw rock phosphate, has been advanced in certain parts of the United States. Since many of the acid soils of Eastern Canada have a high phosphorus-fixing capacity and are usually deficient in phosphorus it was felt that some investigational work should be undertaken with raw rock phosphate. Accordingly a number of studies were undertaken with this material in the years 1954-1956, inclusive.

### Rock Phosphate versus Superphosphate at Different pH Levels

This was a greenhouse study in which Hyperphos and Aerophos were compared with superphosphate as suppliers of phosphorus, at different pH levels, to ladino clover. Comparisons are based on total uptake of phosphorus by the crop. Results of the study are shown in Table 26.

TABLE 26.—EFFECT OF DIFFERENT SOURCES OF PHOSPHORUS ON PHOSPHORUS UPTAKE BY LADINO CLOVER

Treatment lb. P <sub>2</sub> O <sub>5</sub> /ac.	Phosphorus uptake with varying soil pH values						
	5.2	5.6	6.0	6.4	6.8	7.2	Average
	mgm	mgm	mgm	mgm	mgm	mgm	mgm
1. Check.....	166.6	202.7	243.3	236.2	231.2	230.1	218.3
2. Super P-300.....	238.1	300.2	316.8	277.2	266.6	273.0	278.6
3. Aerophos-600.....	239.3	260.4	246.8	248.6	239.1	238.4	245.5
4. Hyperphos-600.....	256.1	252.5	287.2	264.4	230.9	238.8	255.0
5. Super + Aerophos.....	247.8	253.9	306.6	301.8	265.0	243.7	269.8
6. Super + Hyperphos.....	287.6	293.6	320.3	328.2	301.1	219.0	291.6
Average.....	239.2	260.6	286.9	276.1	255.6	240.4	

L.S.D. (.05 for comparing mean P or pH values = 17.1 mgm.

All phosphorus treatments increased phosphorus uptake, with the highest uptake due to superphosphate. As an average under all phosphorus treatments the maximum uptake occurred at pH 6.0. A significant pH  $\times$  phosphorus interaction indicates that uptake from all sources was not uniformly affected by pH. Thus, where no phosphorus was applied the greatest uptake occurred at pH 6.0; with superphosphate the greatest uptake was at pH 5.6. The pH level did not affect uptake from rock phosphate.

After the first crop (8 cuts) of ladino clover was harvested the soil was removed from the pots, nitrogen and potassium were applied, and the soils reseeded to ladino clover. The effect of treatments on soil phosphorus content was determined by "Bray's acid-soluble-plus-adsorbed" method. The yields of clover (total of 5 cuts) and the soil phosphorus levels are shown in Table 27.

All phosphorus treatments increased the soil phosphorus content, with the greatest increases occurring where Hyperphos was applied. The yields, however, in the second seeding were quite low, with very little response to phosphorus, and were not significantly correlated with soil phosphorus. It is quite probable that where rock phosphate is applied the method of Bray does not give a satisfactory measure of the phosphorus available to plants.

TABLE 27.—EFFECT OF DIFFERENT SOURCES OF PHOSPHORUS ON BRAY'S ACID-SOLUBLE-PLUS-ADSORBED PHOSPHORUS AND ON YIELDS OF LADINO CLOVER

Treatment (lb. P <sub>2</sub> O <sub>5</sub> /acre)	Soil phosphorus (p.p.m.)	Yields (grams/pot)
Check.....	36	32.7
Super P-300.....	48	36.2
Aerophos-600.....	81	31.5
Hyperphos-600.....	119	36.1
Super P-300 + Aerophos-600.....	91	34.0
Super P-300 + Hyperphos-600.....	139	38.9

#### Effect of Organic Matter on the Availability of Phosphorus from Rock Phosphate

Various workers have suggested that organic matter is effective in increasing the availability of applied phosphates. It has also been suggested that the acids formed by decomposition of organic matter might help to dissolve rock phosphate. A project was set up in the greenhouse in 1954 to study these relationships. Four different forms of organic matter (at 4 tons dry matter per acre) and six different phosphorus treatments were applied to a crop of ladino clover in the greenhouse. The total yields for seven cuts are shown in Table 28.

TABLE 28.—YIELD RESPONSE OF LADINO CLOVER TO DIFFERENT SOURCES OF PHOSPHORUS IN THE PRESENCE OF SEVERAL ORGANIC AMENDMENTS

Phosphorus lb. P <sub>2</sub> O <sub>5</sub> /acre	Organic Matter					
	Check	Manure	Oat straw	Clover	Starch	Average
Check-0.....	65.9	71.2	58.9	54.8	47.8	59.7
Super P-300.....	69.5	73.4	72.9	75.2	53.9	69.0
Aerophos-300.....	58.4	63.8	64.0	67.8	48.7	60.5
Aerophos-600.....	62.7	81.8	69.4	69.4	42.2	65.1
Hyperphos-300.....	65.2	80.1	66.3	66.1	54.5	66.4
Hyperphos-600.....	71.2	77.9	76.4	70.8	58.9	71.0
Average.....	65.5	74.7	68.0	67.4	51.0	

All phosphorus treatments with the exception of Aerophos at 300 pounds P<sub>2</sub>O<sub>5</sub> increased yields significantly. Manure increased yields over the check while starch reduced them. There was no significant phosphorus  $\times$  organic matter interaction, which indicates that in this study availability of phosphorus was not affected by organic matter.

#### Field Studies with Rock Phosphate

Studies in which two forms of rock phosphate, Aerophos and Hyperphos, were compared with superphosphate as sources of phosphorus were conducted from 1951 to 1956 with grain and hay and from 1954 to 1956 with potatoes.

Although there was a marked response to phosphorus, the rock phosphates failed to increase yields over the checks. It was concluded that rock phosphate is not capable of supplying the immediate phosphorus requirements of field crops.

The use of rock phosphate for building up a reserve of phosphorus in the soil does not seem practical, particularly when it is being offered for sale at the same price per ton as superphosphate.

## Liming Materials

### Dolomitic Limestone

In the Maritimes where a large percentage of the agricultural limestone is dolomitic, the question has been raised as to the probability of yields being reduced through suppression of potassium uptake by the relatively large amounts of magnesium applied in this material. Accordingly, a greenhouse study was conducted in 1954 of the effect of applied Mg/K ratio on yields of clover.

Magnesium oxide and potassium chloride were applied to a sandy loam soil in a 4 x 4 factorial arrangement. Ladino clover was planted as an indicator crop. The total yields for seven cuts are shown in Table 29.

TABLE 29.—EFFECT OF Mg/K RATIO ON YIELD OF LADINO CLOVER (GRAMS/POT) FOR A TOTAL OF 7 CUTS

K <sub>2</sub> O (lb./acre)	MgO (lb./acre)				Average
	0	400	800	1,600	
(Yield in grams per pot)					
0.....	51.7	46.4	48.7	53.4	50.0
100.....	52.9	52.0	53.6	56.4	53.7
200.....	55.2	55.3	56.0	66.9	58.4
300.....	55.8	59.8	60.6	62.2	59.6
Average.....	53.9	53.4	54.7	59.7	
pH.....	6.0	6.6	6.9	7.3	
L.S.D. (.05) for MgO and K <sub>2</sub> O = 2.5					

Magnesium and potassium produced highly significant increases in yields. The rates of magnesium are, however, confounded with pH, so that the increased yields could be due as much to the higher pH levels as to the correction of a magnesium deficiency.

Since there was no magnesium  $\times$  potassium interaction it has been concluded that in this experiment uptake of potassium was not suppressed to the extent of reducing yields.

### Waste Sulphite Liquor as a Soil Amendment

Waste sulphite liquor, a by-product of the paper industry is produced in very large quantities in New Brunswick. A recent change in the pulping process produces an ammonium-base liquor which, in the dried form, contains about 3 per cent nitrogen, 55 per cent ligninsulfonic acids and 17 per cent reducing sugars. A study of the value of this material as a soil amendment was conducted in the greenhouse from 1954 to 1956.

In a greenhouse project this material was compared with ammonium sulphate as a source of nitrogen for oats and rye grass. On the basis of yields of these crops it was concluded that the nitrogen of waste sulphite liquor is 65 per cent to 80 per cent as available as the nitrogen from ammonium sulphate.

In studying sulphite liquor as a source of nitrogen it was observed that it had a stabilizing effect on soil aggregates. It was decided therefore to make a quantitative measurement of the stabilizing effect of this material in relation to that of two known synthetic soil conditioners. The data obtained on three different soils indicate that this material is about  $\frac{1}{16}$  as effective as HPAN and about  $\frac{1}{36}$  as effective as VAMA.

Incubation studies indicate that decomposition of the reducing sugars is responsible for the production of stabilizing compounds.

Other effects of this material are an increase in soil organic matter, depression of soil pH, and a slight but significant increase in exchange capacity.

## SOIL PHYSICS

*(J. J. Doyle)*

### **Soil Conditioners**

In 1952 an experiment was conducted in the field to measure the effect of applied Krilium (HPAN) on soil aggregation and on crop yields. Krilium (Formulation 931) was applied on the surface of an imperfectly drained soil at 0, 1,000, and 2,000 pounds per acre and harrowed in. The area was planted to potatoes and corn in 1952, followed by grain in 1953, and hay in subsequent years.

None of the crops responded significantly to Krilium treatments and no difference in soil structure could be observed. It was concluded that in cases where yields are limited by imperfect drainage application of Krilium to the surface is of no value. It was also concluded that even if an improvement in structure could be brought about to the extent of increasing yields, the cost would be prohibitive.

### **Soil Aeration**

It is generally accepted that continued intensive cultivation of a soil as practiced in the potato growing areas brings about a gradual deterioration of soil physical condition. This deterioration can be readily demonstrated by certain physical measurements such as aggregate analysis, bulk density measurements, etc. It is more difficult, however, to show a relationship between soil physical condition and crop yields. It has been demonstrated by a number of workers that oxygen is essential for plant growth and that availability of oxygen is probably one of the most important properties dependent upon soil structure. In order to obtain some quantitative data relating soil aggregate size, availability of oxygen, and plant growth, experiments were initiated in 1955 in the laboratory and greenhouse.

### **Relationship Between Soil Aggregation, Availability of Oxygen and Growth of Tomatoes**

This was a greenhouse project in which a fine-textured soil was treated with a soil conditioner then crushed and sieved to produce seven sizes of aggregates. With the surface of the soil at a moisture tension of 20 centimeters, diffusion of oxygen was measured by a platinum electrode apparatus. The soils were then planted to tomatoes.

The data showed a highly significant linear relationship between soil aggregate size and availability of oxygen. The yields of tomatoes increased with oxygen to a maximum and then decreased, in a parabolic relationship. It was concluded that the measurement of oxygen using a platinum microelectrode provides a valuable criterion of the physical condition of the soil.

Further work on this technique, in which the effects of temperature and moisture on diffusion are being studied, is in progress.

### **Field Studies with Yields of Potatoes versus Oxygen Supply**

In order to make a field trial of the micro-electrode technique and to establish critical levels of oxygen for potatoes a field project was conducted in the years 1956 and 1957. A sandy loam soil which had been cropped annually to potatoes since 1931 was brought in from the field, treated with a soil conditioner to produce seven sizes of aggregates, replaced in a prepared site in 3 by 3 foot plots. The plots were then planted to potatoes.

Although diffusion of oxygen was directly proportional to aggregate size as in the greenhouse project, no differences in yield resulted from the treatment.

It was concluded that this coarse-textured soil was not affected physically to the extent of reducing yields. In the fall of 1957 in a second attempt to establish critical levels of oxygen for this crop, a fine clay was treated with soil conditioner and planted to potatoes in the spring of 1958.

## CHEMICAL WEED CONTROL

### Field Crops

(C. F. Everett)

*Control of annual broad-leaved weeds in potatoes:* Trials for weed control in potatoes (usually Keswick variety) have been conducted annually with many different herbicides, to determine the most suitable herbicide, rate, and time of application. The only recommended herbicide to date is DNBP amine (sold as Premerge or Sinox P.E.) which consistently provided moderate to excellent control of most annual broad-leaved weeds when used at 3.5 to 5 pounds acid equivalent in 35 to 75 gallons of water per acre applied at the beginning of potato emergence. The higher rates were required at lower temperatures. Annual grasses have never been a serious problem in the plot areas but where barnyard grass, *Echinochloa crusgalli*, was present it was partially controlled by DNBP.

A light cultivation 5 to 7 days before emergence and combination cultivation and hilling at the beginning of potato bloom are sufficient cultural practices in conjunction with DNBP. The recommended rates of DNBP amine have never decreased yields or quality.

2,4-D has usually provided adequate control of broad-leaved weeds when applied as a pre-emergence spray but it has so often caused distortion of the top growth that it is not recommended, especially on potatoes grown for certification. Neburon and other herbicides are promising but either have not had tolerances established by the Food and Drug Directorate or they require additional testing before reporting.

*Herbicides as pre-planting treatments for control of couch grass:* Several tests were conducted to determine the control of couch grass, *Agropyron repens*, provided by a number of new herbicides.

TCA (trichloroacetic acid) applied in the fall to plowed sod gave excellent control of couch during the following spring but considerable re-infestation or regrowth occurred during the next summer.

None of the chemicals applied in the spring at low to medium rates to 6-inch-high couch grass gave higher than 75 per cent control. Six pounds of active maleic hydrazide per acre actually resulted in a 17 per cent increase in couch grass when the hay was harvested 14 months after the herbicide had been applied.

At present from these trials two herbicides, dalapon and amino triazole, show promise as preplanting treatments, especially if they are applied according to directions and under specific conditions.

*Formulations and rates of herbicides on oats and forage seedings:* Herbicide trials, testing formulations and rates of promising new herbicides, on grain and especially on oats undersown with red clover and timothy, have been conducted annually. Information gathered each year was used to formulate the next year's trials. For this reason long-term averages are not available in this series of tests.

*Herbicides on forage seedings:* Several rates of 2,4-D amine and MCP sodium and potassium between 4 and 16 oz. acid equivalent per acre were sprayed on plots of oats 21 days after seeding in 1955. The oats were undersown with Ottawa red clover and timothy. Analysis of variance of the clover hay yields obtained in 1956 indicated a significant difference in yields due to the sprays. The MCP sodium and potassium sprays resulted in a highly significant increase in yields of clover hay compared with those obtained when 2,4-D amine sprays were used.

*Herbicides on oats:* On May 31, 1956, Abegweit oats were seeded with Ottawa red clover, and timothy. Six replications of the herbicide treatments selected from previous experiments, chiefly rates of butyl ester formulations of MCPB and 2,4-DB, were sprayed on July 3. The yield of oats from MCP amine or MCPB butyl ester sprays was generally superior to yields obtained where 2,4-D amine or 2,4-DB butyl ester sprays were applied. The highest rate applied of 2,4-DB butyl ester (24 oz./A.) resulted in the lowest yield of oats.

*Herbicides on certain broad-leaved annual weeds in oats:* Six replications of several herbicides selected from previous trials were sprayed June 29, 1957, on Abegweit oats, Ottawa red clover, and timothy, 25 days after they were seeded. A tractor-mounted sprayer applied the herbicides in 8 gallons of water per acre at a pressure of 30 pounds per square inch. The weeds present in order of density were hemp nettle, lady's thumb (smartweed), and lamb's quarters. The 2,4-D amine at 8 ounces acid equivalent per acre did not damage hemp nettle and was the only herbicide that reduced the stand of seedling clover. No visible damage to oats could be detected due to the herbicides. However, the yield of oats varied because of early lodging in parts of the test area. MCPB ester at 16 ounces acid equivalent per acre gave excellent control of hemp nettle and lamb's quarters and good control of lady's thumb.

*Herbicides for control of Canada thistle:* Several herbicides, promising for control of perennial weeds, were sprayed on plots of Canada thistle, *Cirsium arvense*, in full bud stage and growing in permanent pasture.

Amino triazole, applied in 1956 at 2 and 4 pounds of active ingredient per acre, reduced Canada thistle by two-thirds and wild white clover by one-half to three-quarters for two growing seasons. Both MCPB sodium, and 2,4-DB sodium, each at 30 ounces acid equivalent per acre, reduced the thistle by three-quarters for two seasons and resulted in an increased stand of wild white clover of 42 and 75 per cent, respectively, during the second season.

### Horticultural Crops

(W. B. Collins)

During the period covered by this report tests with herbicides were carried out on peas, snap beans, sweet corn, and strawberries.

Testing of 20 different herbicides on the vegetable crops was limited to pre-emergence materials. The amine formulation of DNOSBP (Dow Premerge) gave excellent weed control when applied pre-emergent to the crop at the rate of 4 pounds of active material in 50 gallons of water per acre. Other materials which hold some promise for use on these crops but which have not yet been sufficiently tested are Neburon, Mylone, and Simazin. The latter two proved toxic to beans but may be of value for peas and corn.

In trials with newly set strawberries some twelve materials have been tested during the past five-year period. SES (Crag Herbicide #1) has proved

effective when applied early in the planting year at rates of 2 to 4 pounds in 50 gallons of water per acre. This material, however, should not be used when the plants are setting runners during the period of fruit bud differentiation.

Neburon is a promising new material that has given good weed control in the tests when applied at 2 to 4 pounds of active ingredient in at least 100 gallons of water per acre. This material was used monthly throughout the season without damage to the strawberry plants. At time of writing Neburon has not been licenced and is not available for commercial use.

For the control of late fall growth of chickweed in strawberries, tests showed 3 pounds of chloro IPC in 50 gallons of water per acre to be very effective. This material must be applied only in late fall after the plants are dormant.

Other materials that appear promising but require further testing are EPTC, VPM, and Mylone.

## ILLUSTRATION STATIONS

(E. A. Grant and J. E. Comeau)

Illustration Stations presently in operation in New Brunswick with the year of establishment and the names of operators are as follows:

Station	County	Operator	Year Established
Baker Brook	Madawaska	Claude Levasseur	1945
Belleisle Creek	Kings	Howard O'Neill	1953
Cumberland Point	Queens	Robert Beam	1940
East Centreville	Carleton	Ernest Emery	1942
Lower Derby	Northumberland	W. R. Taylor	1921
Millville	York	Allison Hawkins	1954
Mont Carmel	Kent	Cloris Melanson	1942
St. Isidore	Gloucester	Peter Robichaud	1927
St. Quentin	Restigouche	Fernand Dubé	1945
Salisbury	Westmorland	Truman Lewis	1928
Salmonhurst	Victoria	Jens Larsen	1950
Siegas	Madawaska	Romeo Ruest	1924
South Tetagouche	Gloucester	William Oliver	1953

During the period covered by this report, operations were suspended at four stations, Currieburg, St. Charles, Silver Falls, and Welsford operated by Howard Sandwith, Antoine Daigle, A. B. Shillington, and T. C. McCullum, respectively. Three of the stations listed above, Belleisle Creek, Millville, and South Tetagouche were opened during the period.

The work conducted under this Division with the exception of Farm Business Studies is outlined in other sections of this report.

## Farm Business Studies

Inventory records for 12 stations, covering periods during the years from 1941 to 1957 show that an average of 53 per cent of the capital investment was in land and buildings, 19 per cent in livestock, and 28 per cent in machinery and equipment.

In the last five years the figures show a slight drop in the amount of capital invested in land and buildings and in livestock. An 11 per cent increase is evident for machinery and equipment which shows the trend toward more mechanization and the use of more labor-saving equipment. Over the period

under study there has been an increase in the total capital investment per acre as well as an increase in gross receipts per acre. The relationship between investment per acre and gross receipts per acre has been consistent over the years, i.e., those farms that have the greatest investment per acre have also the largest gross receipts per acre. The figures for different types of farming on Illustration Stations are summarized in Table 30.

TABLE 30.—DISTRIBUTION OF TOTAL CAPITAL, CAPITAL INVESTMENT PER ACRE AND GROSS RECEIPTS PER ACRE

New Brunswick Illustration Stations, 1941 to 1957.

Type of Farming by Individual Stations	Percentage of Total Capital Investment			Investment per acre of crop land	Gross receipts per acre of crop land
	Land and buildings	Livestock	Machinery and Equipment		
	%	%	%		
Mixed <sup>1</sup> .....	47	25	28	195	63
Potato and Beef <sup>2</sup> .....	42	8	50	183	68
Dairy.....	58	22	20	263	112
Mixed <sup>2</sup> .....	53	31	16	186	92
Dairy.....	57	20	23	142	49
Mixed <sup>3</sup> .....	40	23	37	154	62
Mixed.....	69	19	12	128	33
Mixed.....	58	14	28	160	63
Mixed <sup>4</sup> .....	60	12	28	240	61
Potato Mixed <sup>5</sup> .....	45	17	38	271	113
Dairy <sup>6</sup> .....	53	27	20	275	108
Potato <sup>6</sup> .....	52	7	41	290	198
Average 1941-57.....	53	19	28	207	85
Average 1941-51.....	56.4	20.4	23.2	190	79
Average 1953-57.....	50.0	16	34	200	80

<sup>1</sup>1945-57, <sup>2</sup>1942-57, <sup>3</sup>1946-57, <sup>4</sup>1954-57, <sup>5</sup>1955-57, <sup>6</sup>1950-57.

## AGRICULTURAL ENGINEERING

(C. F. Everett)

### Evaluation of a Stone Picker

Stones cause difficulty in the operation of potato harvesters in many potato growing areas of New Brunswick, bruising the tubers and presenting a problem in separation during the digging operation.

A stone picker, designed by the University of Maine, was tested at Fredericton in 1956. This unit, adapted to a two-row potato digger, is capable of digging, sifting and loading approximately 5 tons of stone in 10 minutes, provided there are no delays caused by stones wedging in the digger elevators. The field must be in bare fallow, and fairly dry to prevent the removal of soil and sods with the stones. For level fields, or with only moderate slopes, the digger with the stone picking attachment requires at least a 30-horsepower tractor for adequate performance at plowing depth.

### Value of Hay Conditioner

Cracking the stems of forages, especially legumes, is one of the most promising advances in drying forage crops. The purpose is to accelerate the drying of the stems and thus prevent overdrying and shattering of the leaves. Tests were conducted at Fredericton during 1956 and 1957 comparing the rate of drying of crushed and uncrushed hay, using mixtures of 50 to 75 per cent medium red clover with timothy. Moisture determinations were obtained

periodically, usually every hour, during the drying period. The hay was wind-rowed when it had wilted to between 40 and 50 per cent moisture and baling was started when the hay had dried below 25 per cent.

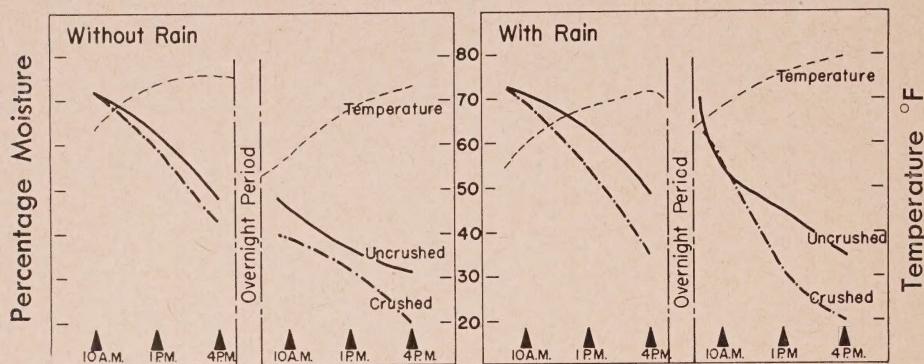


Figure 2

Figure 2 shows that crushed hay dried faster. The field trials indicated that crushed hay required at least one less drying day in field-curing than the uncrushed hay. When rain occurred during the field-curing, the crushed hay dried faster following the rain than the uncrushed hay.

The machine used in the trials was a combination seven-foot mower and power-take-off-operated crusher with two 6-inch rollers. When operated by a two- or a three-plow tractor it reduced the speed of mowing by 25 to 40 per cent depending on the density of the crop. There was some difficulty in obtaining an even flow of the swath through the rollers especially when turning the corners. Observations of other conditioners in operation indicate that this difficulty is mainly due to the size of the rollers. Larger rollers do not clog as readily.

The value of this machine in the haying operations is determined primarily by the value placed on the higher digestibility of earlier cut and more rapidly cured hay.



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